F. Lindheimer

MISSOURI

BOTANICAL GARDEN.

EIGHTEENTH ANNUAL REPORT.

ST. LOUIS, MO.:
PUBLISHED BY THE BOARD OF TRUSTEES.
1907.

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A. D. CUNNINGHAM, Secretary.

**Ex-Officio.*

[1] Elected President of the Board of Public Schools of St. Louis, October 8, 1907, to succeed George R. Lockwood, who had held that office for one year.

[2] Elected President of the Academy of Science in January, 1907, to succeed Adolf Alt, who had held that office for two years.

PREFACE.

Under direction of the Board of Trustees, the eighteenth annual report of the Missouri Botanical Garden is presented to the public.

The seventeenth volume was issued on November 6th, 1906, which is to be regarded as the date of publication of the scientific papers it contains, except that by Dr. Spaulding, separates of which were distributed on August 31st, 1906, and those by Dr. Hedgcock, separates of which were distributed on September 27th, 1906.

These reports are sent to scientific institutions and journals in exchange for publications or specimens desirable for the Garden, and, when possible, reprints of the botanical articles they contain are presented to botanists occupied with a study of the subjects they refer to. Any of the Garden publications not out of print may be purchased at approximately the cost of publication from Mess. R. Friedländer & Sohn, Berlin, Germany; W. Wesley & Son, London, England; or the undersigned.

WILLIAM TRELEASE.

ST. LOUIS, MO., Oct. 10, 1907.

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LIGHT AND SHADE.

REPORTS FOR THE YEAR 1906.

REPORT OF THE OFFICERS OF THE BOARD.

SUBMITTED TO THE TRUSTEES JANUARY 9, 1907.

To the Board of Trustees of the Missouri Botanical Garden:

We submit for your consideration the financial results for the year ending December 31st, 1906.

The receipts from rentals are $6,310.31 above those of the year 1905 and, on account of increased rentals on certain properties, we anticipate a further increase of $5,000.00 during the coming year. All of the properties of the Board have been kept in good repair and all are occupied with the exception of two small pieces, bringing in a rental when tenanted of $55.00 per month.

We have disposed of 260 feet fronting on Flora Boulevard for a total sum of $20,097.00 and already residences have been erected on most of the ground sold.

The Board, in order to extend its holdings at No. 514 Washington Avenue through to St. Charles Street, purchased a piece of ground fronting on St. Charles Street, 14½ feet by a depth of 75 feet, improved with a three-story building, for $37,500.00, which we have leased for a term of 25 years at the rate of 4.80% net on the purchase price, in connection with our former holding.

We have also leased, for a term of 99 years from January 1st, 1908, the premises known as No. 608 Olive Street, at an annual rental of $10,000.00 net, which is an increase of 100% over the price we are receiving at present.

The demands for special taxes for streets and sewer improvements have been unusually light, amounting to only

$6,200.38 for the year, but the street improvements referred to in our last report, in addition to others, are under way and will no doubt be finished during the year, as follows:—

Old Manchester Road	$20,000 00
Tower Grove Avenue	25,000 00
Klemm Street	800 00
Vandeventer Avenue	800 00
Spring Avenue	14,000 00
Total	$60,600 00

The following amounts have been credited to the Stock Account:—

Library	$4,799 82
Herbarium	5,363 30

The annual bequests provided for in Mr. Shaw's will have been carried out with the exception of the flower show, none being held, at a cost of $2,323.00.

The Board has had under consideration for some years the securing of an oil portrait of Mr. Henry Shaw, there being no good likeness in existence. During the past year a full length life size portrait has been painted by Mr. R. E. Miller of Paris, late of St. Louis, from portraits and photographs and corrected in accordance with suggestions offered by friends of Mr. Shaw, which is considered a perfect likeness. This portrait has been temporarily deposited at the Museum of Fine Arts located in Forest Park until a suitable location is found at the Garden.

RECEIPTS.

Rentals	$127,053 25	
Unearned rentals	4,825 00	
Interest and dividends	3,850 65	
Garden pasturage above expenses, etc.	95 60	
Garden hand-book sales	179 00	
Publication sales	8 28	
Total income collections		$136,011 78

Brought forward		$136,011 78
Sales of real estate under decree of court .	$20,097 00	
Bills receivable	6,000 00	
Insurance on buildings damaged	4,322 28	
Shaw School of Botany, rent	3,900 00	34,319 28
Total receipts		$170,331 06
Cash on hand December 31st, 1905 .		2,294 68
		$172,625 74

DISBURSEMENTS.

Garden Account,			
Labor pay-roll	$19,475 75		
Students' pay-roll . . .	1,601 94		
Office assistance	1,705 00	$22,782 69	
Fuel		1,818 78	
Water		248 50	
Repairs and supplies		1,811 26	
Plants and seeds		898 31	$27,559 54
Herbarium Account,			
Salaries		1,157 15	
Fuel		166 33	
Current expenditure		1,512 28	2,835 76
Library Account,			
Salaries		2,750 90	
Fuel		184 62	
Current expenditure		1,998 76	4,934 28
Office Account,			
Salaries		4,698 95	
Fuel		113 60	
Current expenditure		462 76	5,275 31
Research Account,			
Salaries		1,496 06	
Current expenditure		108 39	1,604 45
Scholarship Account,			
Instruction		726 25	
Care of Lodge		240 00	
Fuel		37 75	
Current expenditure		128 72	1,132 72
Total maintenance			$43,342 06
Garden improvement,			
North American synopsis, brook . . .			510 20
Total amount expended on Garden .			$43,852 26

Brought forward		$43,852 26
Publication Account,		
Seventeenth annual volume	1,673 36	1,673 36
Property Expenses,		
State, school, city and sprinkling tax . .	37,271 28	
Streets, sidewalks and sewers	6,200 38	
Insurance	5,253 23	
Repairs	6,763 71	55,488 60
Office Expenses,		
Salaries	4,200 00	
Office rent	900 00	
Printing, advertising, telephone, etc. . .	603 00	5,703 00
Bequests,		
Annual Flower Sermon	200 00	
Gardeners' Banquet	508 58	
Trustees' Banquet	980 85	
Washington University, School of Botany.	633 57	2,323 00
Sundries,		
Real estate	37,500 00	
Bonds, stocks and certificates	2,800 00	
Legal expenses	987 45	
Repairs to building damaged by fire . .	4,172 28	
Shaw School of Botany, rent, etc. . . .	3,961 75	
Commissions	5,365 00	
Portrait of Henry Shaw	1,068 00	55,854 48
		$164,894 70
Cash on hand December 31st, 1906 .		7,731 04
		$172,625 74

Respectfully submitted,

R. J. LACKLAND, President.

Attest:

A. D. CUNNINGHAM, Secretary.

CAT TAILS.

EIGHTEENTH ANNUAL REPORT OF THE DIRECTOR.

SUBMITTED TO THE TRUSTEES JANUARY 9, 1907.

To the Board of Trustees of the Missouri Botanical Garden:

The following report on the Missouri Botanical Garden and the School of Botany connected therewith is respectfully submitted in compliance with the rules of the Board.

GARDENING.

In its general features, the decorative gardening of the past year was a repetition of that of several preceding seasons. Tulips occupied the parterre in the spring, and choice foliage plants during the rest of the open season, a large bed being devoted to each named variety, planted in mass. Rather more roses than usual were grown, and a rearrangement of the synoptical rose beds fronting the Linnean House greatly increased their beauty. The planting of the lily ponds was also done more effectively than usual, and the larger pond, in which the two species of *Victoria* were grown side by side, has rarely been as attractive as during the season just closed.

The synopsis of about 1,400 North American plants, following the Bentham and Hooker sequence of families, and planted in an open park arrangement,* was this year thrown open to the public and has attracted much attention. As its trees increase in size, this tract of some twenty acres is destined to become one of the most beautiful parts of the Garden, as it already is one of the most interesting to botanical visitors. Ultimately, an entrance-way opposite the gate of Tower Grove Park is planned, which will admit

* Rept. Mo. Bot. Gard. **8**: 38. **17**: 16.

visitors to the initial group of plants, the Ranunculaceae, from which a walk leads through the synopsis, returning to near the starting point where it ends with the Pteridophytes. Pending the opening of this entrance, visitors are admitted to the North American tract from the southern end of the old arboretum, and pass along the eastern side of the new part to the beginning, if they wish to follow the indicated sequence of plant families.

At the place of departure from the arboretum and flower garden an enclosed experimental garden has been formed, and around this in botanical order are compactly bedded 1,654 species of plants, chiefly hardy herbaceous perennials, for most of which regular use has not yet been found in either the synopsis or decorative beds. This trial ground is supplemented by small but instructive collections of forage plants, farm crops, bee plants, and savory herbs. In the northeastern part of the park devoted otherwise to North American plants, and not far from these testing and economic grounds, a triangular space enclosed by shrubbery has been planted to a collection of 325 medicinal plants, grouped according to their reputed physiological properties. During the past season the center of this area has been used for a small collection of species and their varieties, showing in contrast the presence or absence of certain characters,—*e. g.*, pubescence and the absence of hairs, spines and their absence, colored flowers and albinos, etc. All of these specifically instructive additions to the primarily decorative parts of the Garden are proving to possess an attractiveness to visitors nearly equal to that of the more showy older features, which are themselves so arranged and labeled as to give instruction while affording pleasure.

As in 1905, chrysanthemums were grown on a large scale during the season, and for the fortnight ending with November 24th a collection of 316 varieties, represented by about 4,000 well grown plants, was displayed under a tent nearly 100 feet in diameter which covered the larger part of the parterre. The plants were artistically arranged, and so grouped as to illustrate the principal types of blossom recognized by chrysanthemum experts. According to an

interview reported in one of the daily papers, the exhibit was said by a cultured Japanese visitor "to equal if not surpass the most luxuriant royal exhibits of Japan." The weather during the time that these plants were displayed was phenomenally bad. The maximum temperature ranged between 30° and 46° F., except once, when it reached 59°, and the minimum lay between 19° and 35° F., except for one night when it marked 41°. Nearly half of the time a dense pall of smoke overhung the city, and for a considerable part of three days artificial lights were necessary in the Garden office. One day the ground was covered with 2½ inches of snow. It rained on three days; and through two other whole days a heavy sleet storm prevailed. Out of the entire twelve days, there were but three that could be called pleasant, and they were cold and frosty. I wish especially to thank the gardeners and garden pupils who, after having grown the plants to perfection, cared so well for them under a thin shelter of canvas that nearly all continued in good condition for the entire fortnight, and who through the same period aided visitors or stood uncomplainingly in the cold awaiting a demand for their services. The press, as always, was of much assistance in calling public attention to the flowers; and, as was the case last year, the street car company hung special placards on many of its cars. My thanks for these helps in bringing the attractions of the Garden before the public cannot be too strongly expressed. Above all, I desire to record my appreciation of the assistance rendered by Captain Robert McCulloch, of the United Railways Company, who, when the smoke-cloud made it impossible for those who came to the Garden to see anything, and when ordinary service could not be promised within less than two or three days, installed an ample circuit of electric lights in the tent in less than two hours from the time that his aid was asked.

Notwithstanding the storms and darkness, 16,932 persons saw the chrysanthemums. For the first time in its history, the Garden was opened (for this feature) until ten o'clock at night on the last eight days of the exhibition and although half of the open evenings were stormy, 2,657,

or 15 per cent, of the visitors noted above, came in the evening. It is safe to say that very few of these evening visitors could have seen the chrysanthemums at all if the lighting of the tent had not made possible its opening to them at night.

Plant and seed accessions for the year, aside from Garden propagations and collections, number 291, comprising 17,123 plants or packets of seeds. Of these, 8,568, representing 214 of the accession entries and valued at $511.20, were presented or received in exchange for similar material or for Garden publications; and 6,324, representing 52 entries, were purchased, the Secretary's books showing an expenditure of $898.31 for such purchases, including transportation and other charges. The Garden collections, exclusive of seeds for exchange purposes, number 1,774 plants, valued at $150.47, and 457 packages of seeds, valued at $24.35. Garden propagations amounted to 27,702 plants, valued at $1,939.14.

The exchange list issued by the Garden in December, 1905, included 1,382 species or varieties, and correspondents have been given 4,935 packets of seeds, valued at $248.20, selected from this list; also 984 plants, valued at $147.50. Surplus plants, including some of those removed from the ground on the approach of winter, have been distributed to charities and the public schools. At the close of the chrysanthemum show the plants not needed by the Garden were likewise given to charities, together with a large number of cut flowers. The number of plants so distributed through the year amounts to 846.

The records show that 1,587 species or varieties were added to the collection of living plants during the year, while 491 were lost or discarded, leaving a net gain of 1,096; the total at the end of the year being 17,072, in contrast with the 15,976 noted for the preceding year.* The larger part of the increase falls in the hardy herbaceous and succulent departments.

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* Rept. Mo. Bot. Gard. **17**: 29.

THE WEATHER.

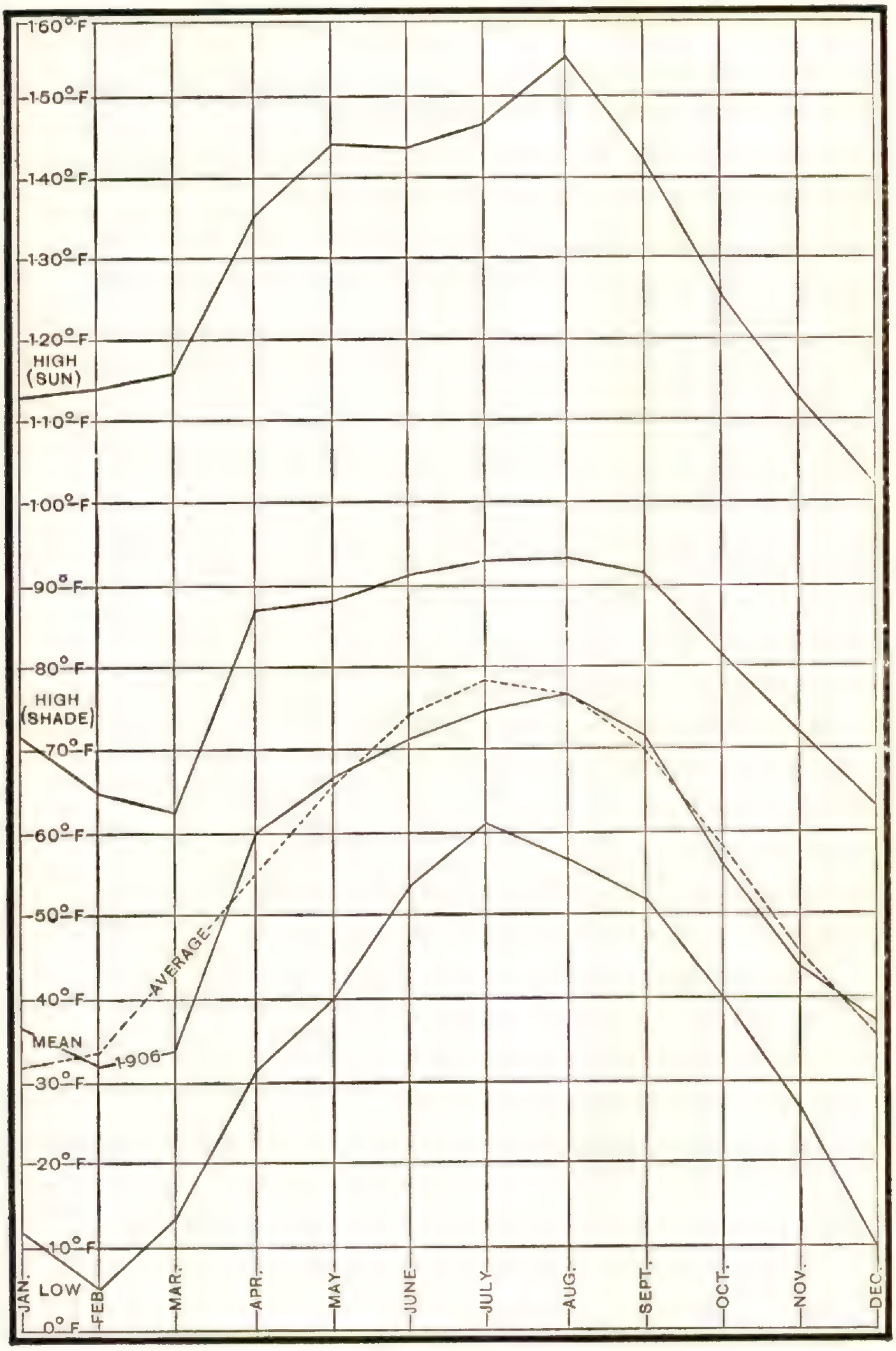
The temperature on the whole has been favorable through the year. Once more a fairly cool summer is to be recorded, the daily mean for August equaling the average, and that for June and July falling below the average by three degrees. For comparison, the minimum and the shade and solar maxima for each month are likewise platted on the accompanying diagram (A), which, except for the solar maximum, is based upon the monthly sheets issued by the local office of the Weather Bureau. It will be observed that although extremely cold weather was not experienced, the mean for February was two degrees below the average, while March reached the customary February average:—a condition practically translated into unusually high expenses for heating the plant houses and a decreased number of visitors for the latter month, which was stormy as well as cold.

In contrast with these two conditions of temperature, the distribution of rainfall has been distinctly unfavorable to gardening, being far below the average during the most important season, from April to June inclusive, the drought continuing through July, and being then equalized by short heavy showers rather than slow soaking rains until toward the close of the growing season. The total precipitation for the year (Diagram B) amounts to 1.54 inches less than the earlier average, as given by the Weather Bureau.

VISITORS.

The total number of visitors for the year reached 117,553—a figure not before equaled except in the World's Fair year. Of this total, 27,831 were recorded for the open Sunday afternoon in June, and 12,215 for the open Sunday afternoon in September, the remaining 77,507 being week-day visitors. Diagram C shows the distribution of the latter through the season, contrasted with the average for the period covered by records (except for the aberrant

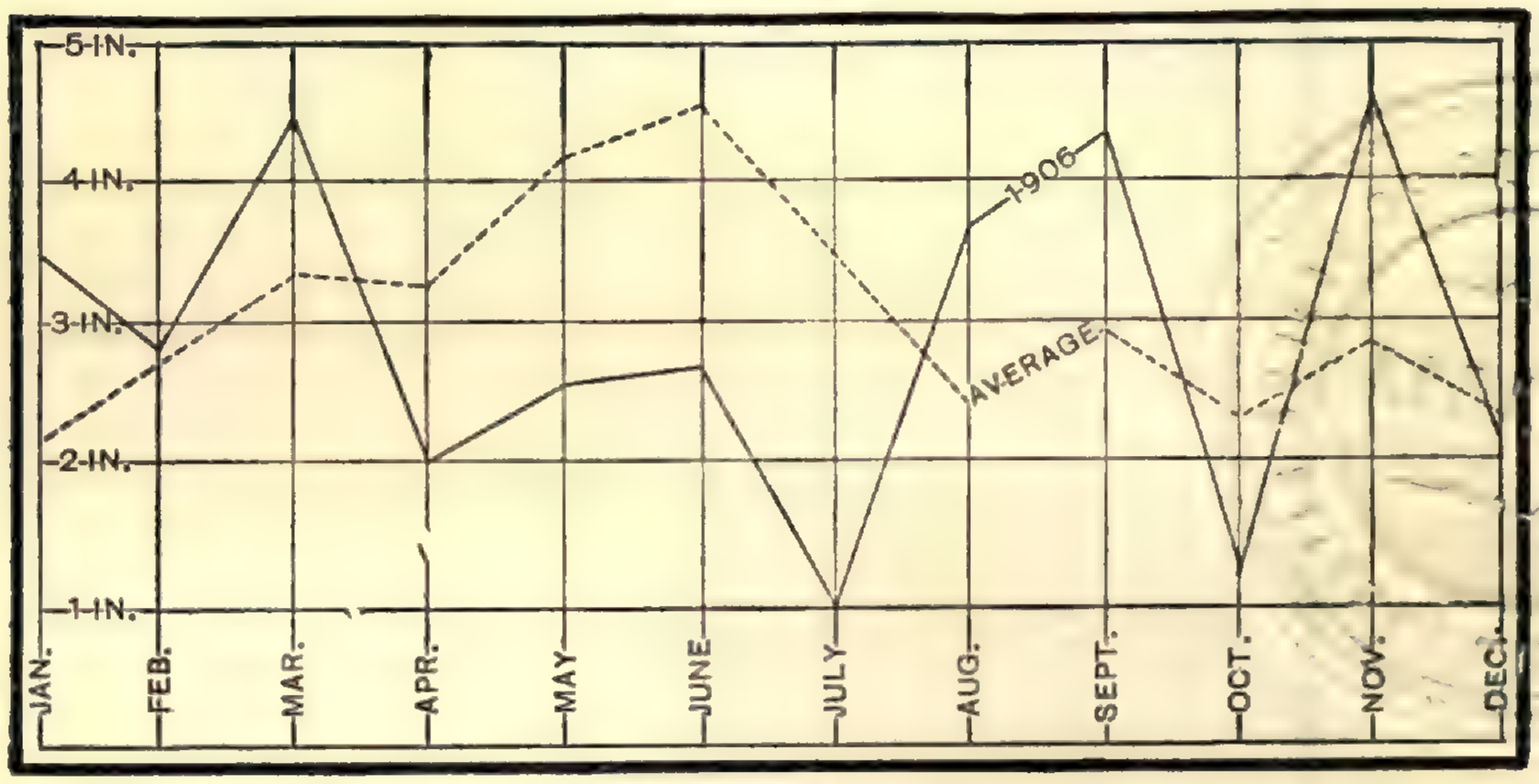
DIAGRAM A.



TEMPERATURES.

years 1902* and 1904,† the very unusual number of November visitors last year‡ being also omitted from the aver-

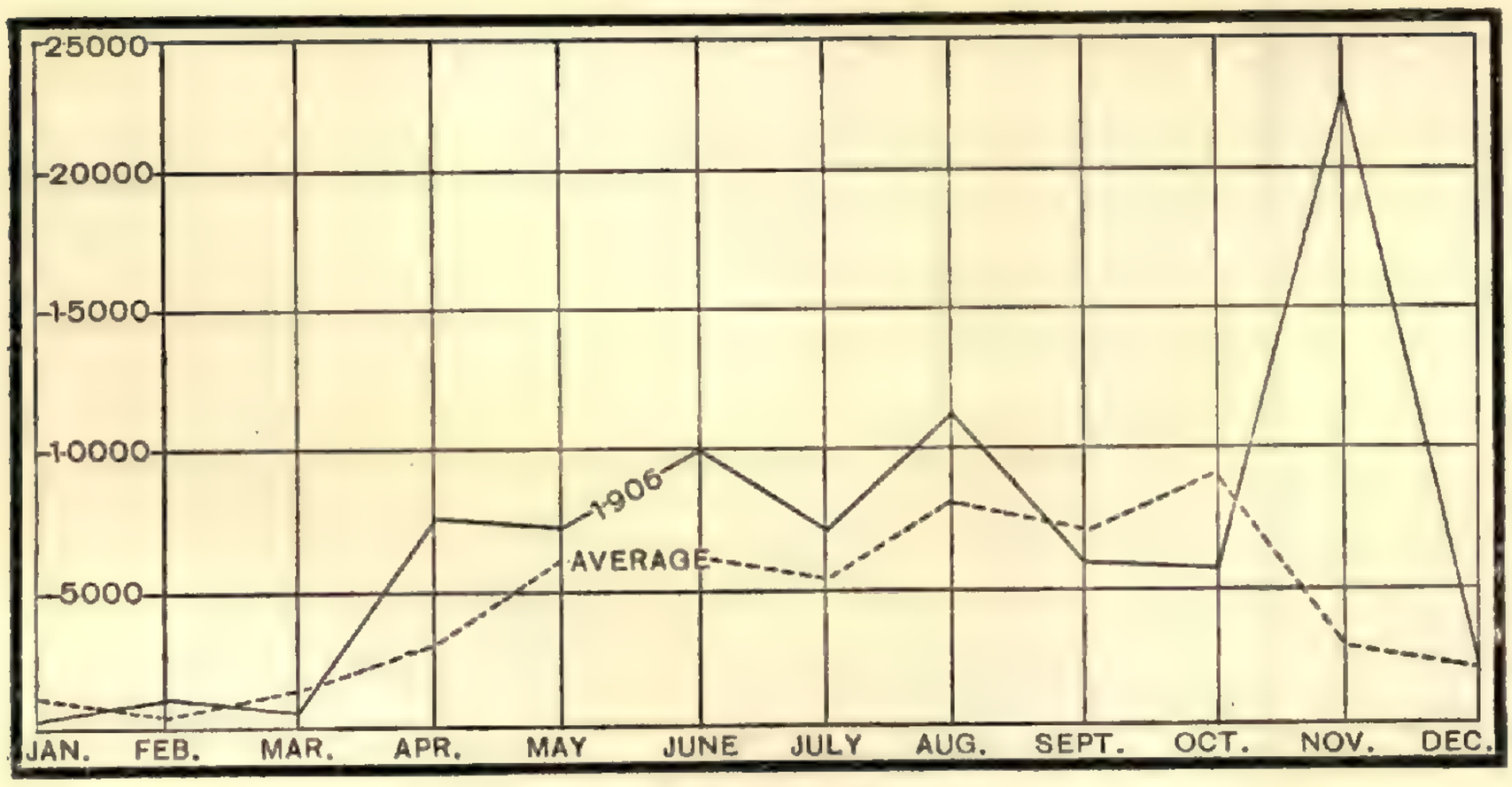
DIAGRAM B.



PRECIPITATION.

age curve). The deterrent effect of the cold and stormy weather of March and of the rainfall of September have

DIAGRAM C.



VISITORS ON WEEK-DAYS.

as evidently modified this diagram as have the favoring weather conditions during most of the spring and summer,—

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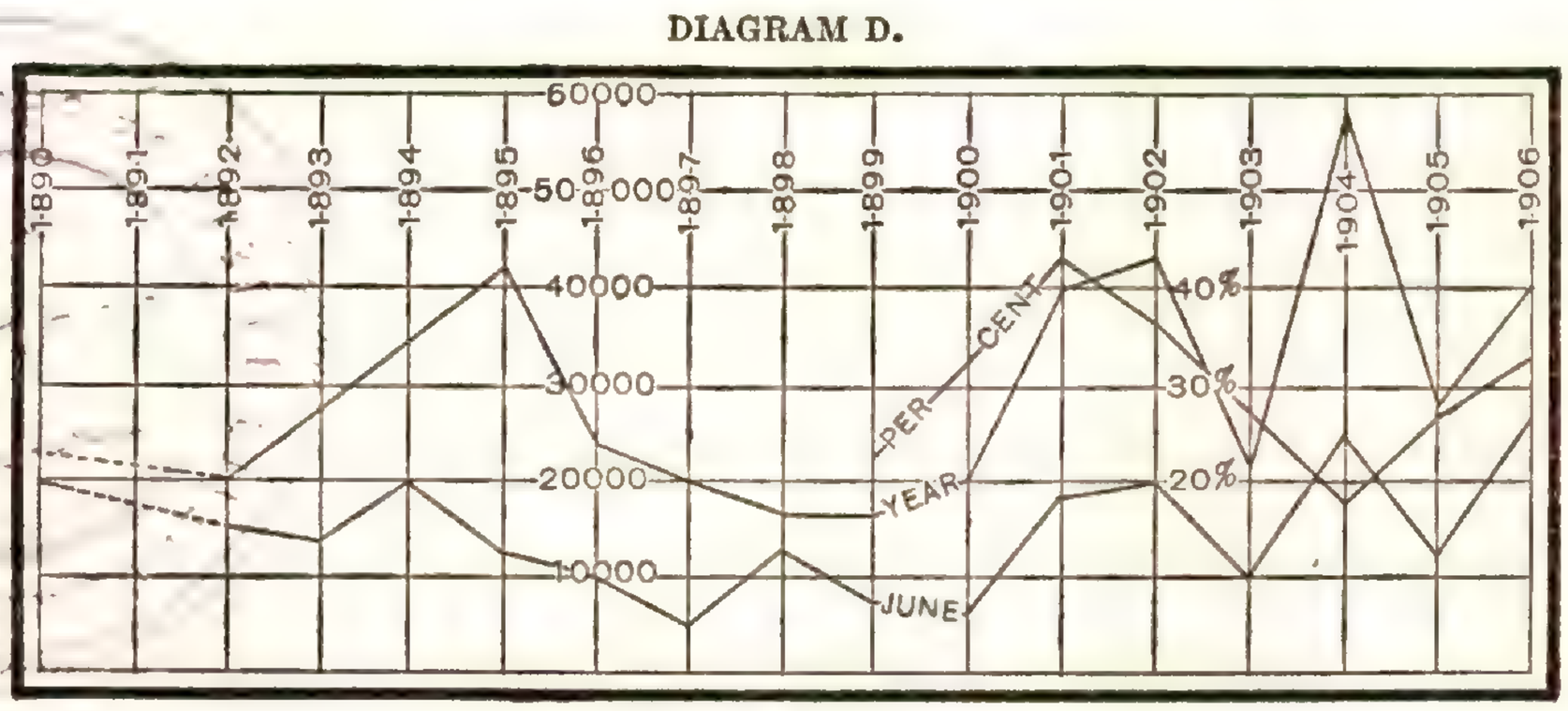
* Rept. Mo. Bot. Gard. **14 :** 17.
† Rept. Mo. Bot. Gard. **16 :** 17.
‡ Rept. Mo. Bot. Gard. **17 :** 32.

the unusual number of visitors in November being due to the advertised display of chrysanthemums already mentioned. The relation of Sunday to week-day visitors, who this year reached 34 per cent of the total, is graphically

DIAGRAM D.



SUNDAY VISITORS.

shown on Diagram D. During the year, 716 copies of the little Handbook of the Garden were bought by visitors.

THE HERBARIUM.

As in 1905, the herbarium has been enlarged by the addition of much important material, including the usual current collections procured by purchase. Early in the season the herbarium of the late Julien Reverchon was bought, and perhaps one-fourth the collection, especially rich in the plants of Texas, has been mounted. Other large items of the year have been 4,600 additional sheets of the Eggert Herbarium, 3,356 sheets of local specimens collected by the late Nicholas Riehl, acquired many years since by Mr. Shaw but not heretofore included in the census of the herbarium, and 925 duplicate western plants collected by Dr. David Griffiths and presented by the National Herbarium.

The incorporated additions for 1906 amount to 35,422 sneets of specimens, of which 6,726, valued (unmounted) at $336.30, were presented or received by way of exchange; 2,812, valued at $140.60, were collected by employees; and

BY THE WATERSIDE.

25,884 were bought, the expenditure for specimens and material amounting to $1,512.28.

The herbarium, so far as now mounted, consists of:—

The Engelmann Herbarium (all groups)			97,859 specimens.
The General Herbarium:—			
Higher plants.			
The J. J. Bernhardi Herbarium	61,338		
The Henry Eggert Herbarium*	23,494		
The J. H. Redfield Herbarium .	16,447		
The Sturtevant and Smith Herbarium	7,446		
The Gustav Jermy Herbarium .	4,789		
The A. W. Chapman Herbarium*	3,536		
The Julien Reverchon Herbarium*	5,809		
The Nicholas Riehl Herbarium .	3,356		
Other specimens	288,727	414,942	
Thallophytes.			
The J. J. Bernhardi Herbarium*	610		
The Gustav Jermy Herbarium .	1,659		
The S. M. Tracy Herbarium* .	4,312		
The Wm. Trelease Herbarium .	11,000		
Other specimens	28,885	46,466	"
Making a total of . . .		559,267	"
Valued at			$83,890 05†

Details concerning the larger exsiccatae of the herbarium are given in an earlier report,‡ and need not be repeated here, as only small current additions are to be noted.

As supplementing the herbarium and the shelved or incorporated exsiccatae, the following material should be mentioned:—

ADDED IN 1906.

Wood, seeds, etc., purchased from the St. Louis Public Museum . . . . . nominally valued at $ 50 00

---

* So far as yet incorporated.

† This valuation, at the rate of $15.00 per hundred mounted sheets.

‡ Rept. Mo. Bot. Gard. **16**: 21.

Brought forward . . . . . $ 50 00

PREVIOUSLY REPORTED.

Wood specimens of various sizes . . . 800 valued at $ 55 00

Wood veneers.

Spurr's cabinet of veneers from the Jesup collection		541	veneers,
Hough, American Woods,	10 fascicles,	750	"
Michel, Feine Holzschnitte,	2 "	285	"
Nördlinger, Querschnitte,	11 "	1,100	"
Sykyta, Das Holz . .	1 "	25	"
Tokyo Imperial Museum, Useful Woods . . .	1 "	255	"
Together . . .	25 "	2,956	" valued at $175 00

Microscope slides.

Penhallow, N. A. Coniferae . . .	268	slides,
Other slides	1,583	"
Together	1,851	" valued at $410 00

Total valuation $690 00

THE LIBRARY.

Current library work has continued through the past year on about the same basis as in 1905. The list of biological serials, reported on a year ago, though still unfinished has now been brought very near the point where its publication can be considered. In addition to the preparation of this list, various sections of the library have been revised, and during the year some 7,700 of the catalogue cards have been replaced by new and verified cards.

Additions number 938 books, valued at $1,698.25, and 2,150 pamphlets, valued at $382.20, presented or received in return for Garden publications; and 294 books and 239 pamphlets bought, the expenditure for purchases and binding amounting to $1,786.29. One of the most interesting of the accessions of the year is a series of publications on chrysanthemums and dahlias, presented by Mr. Wilhelm Miller, associate editor of the Cyclopedia of Amer-

ican Horticulture, and accompanied by extensive manuscript notes accumulated during his study of these plants for the Cyclopedia.

The card index has been enlarged by the addition of 90,817 cards, of which 78,520 were written by employees; 11,434 were purchased; and 863 were presented.

The distinct serial publications now received number 1,359, of which 95 are bought, and 1,264, issued by 905 institutions or publishers, are received in exchange for the Reports of the Garden. This number is 122 larger than that reported a year since, partly through the addition of new journals and partly because of the restoration of exchange relations which had lapsed.

As now constituted, the library contains:—

Pamphlets	31,577			
Books	23,241			
	54,818	valued at		$82,400 73
Manuscript volumes	77	"	"	910 00
Total	54,895	"	"	$83,310 73
Index cards	571,253	"	"	5,712 53
Total valuation of library				$89,023 26

RESEARCH AND THE USE OF FACILITIES.

Such time as could be spared from their immediate duties has been given to investigation by a number of Garden employees, by whom scientific papers have been published or are in course of preparation. The use of Garden facilities by visiting botanists and the loaning of material to those unable to come to St. Louis but desiring it for their studies, have been on about the same scale as for several preceding years.

THE HENRY SHAW SCHOOL OF BOTANY.

The teaching staff and electives offered remain as reported a year since.* The enrollment for the first term of 1906–7 was as follows:—

"Biology 1," 14; "Botany 1," 5; "Botany 3," 4; "Botany 9," 3,—a total of twenty-six students, of whom the fourteen first noted give about equal time to botany and zoology, the others taking one full botanical course each.

At the 1906 Commencement of Washington University the degree of Doctor of Philosophy was conferred on Mr. George G. Hedgcock and Mr. Perley Spaulding, whose major work was in the field of botany, and whose theses form part of the Seventeenth Report of the Garden. There are now enrolled at the University one candidate for the Master's degree and one for the Doctor's degree, with botany as a major study.

GARDEN PUPILS.

No changes have been made in the course of instruction in gardening, or in the teaching staff, and the pupils remain as last year, except that in July Mr. William A. Federer, who had held a scholarship since April 1, 1904, left the Garden to accept a position in an engraving establishment.

THE GARDEN STAFF.

The only changes in the office force to be reported are the engagement of Professor J. W. Blankinship in the latter part of the year, as Herbarium Assistant, to take the place vacated by the resignation of Mr. A. G. Johnson, who, after three years of very efficient service, returned to his studies and duties at the South Dakota Agricultural College; and the return of Miss N. L. Harris to her studies at the Univer-

* Rept. Mo. Bot. Gard. 17 : 38.

sity of Kansas after two years of efficient service as Cataloguer in the Garden library.

In March I had the pleasure of representing the Garden at the celebration of the fiftieth anniversary of the founding of the Academy of Science of St. Louis; and in April, by direction of the Board of Trustees, I had the further honor of officially representing the Garden at the Franklin bicentennial celebration in Philadelphia, under the auspices of the American Philosophical Society. Publications commemorative of both of these events have been placed in the Garden library.

SPECIAL TESTAMENTARY PROVISIONS.

Three special events provided for by the will of Mr. Shaw have taken place in 1906, as follows:—

The annual flower sermon was preached in Christ Church Cathedral, St. Louis, on the morning of May 20th, by the Right Reverend Davis Sessums, Bishop of Louisiana.

The Trustees' banquet was given at the Southern Hotel, St. Louis, on the evening of Saturday, May 5th, 1906, a considerable number of the 140 persons present being members of the Classical Association of the Middle West and South, which was then meeting in the city. Mr. Chaplin presided, and speeches appropriate to the occasion were made by Dean A. F. West of Princeton University, President R. H. Jesse of the University of Missouri, Professors W. G. Hale of the University of Chicago, M. S. Slaughter of the University of Wisconsin, W. W. Kelsey of the University of Michigan and Walter Miller of Tulane University, and Mr. F. W. Lehmann of St. Louis.

The seventeenth gardeners' banquet was given at the Hotel Jefferson, St. Louis, on the evening of August 14th, 1906. There were present 155 persons, of whom about one-half were members of the American Apple Growers' Congress, which was then holding its fourth annual meeting. The Director of the Garden presided. After dinner speeches were made by Hon. H. N. Dunlap, of Savoy, Illinois, President of the Congress; Mr. James Gurney,

Head Gardener Emeritus of the Garden; Professor T. J. Burrill, of the University of Illinois; Mr. H. C. Irish, President-elect of the St. Louis Florists' Club; Professor C. H. Dutcher, of Warrensburg, President of the Missouri Horticultural Society; and Mr. Walter Williams, of Columbia, Missouri.

No competitive flower show having been held in St. Louis in 1906, the bequest for premiums was not made use of.

Very respectfully,

WILLIAM TRELEASE,
Director.

SCIENTIFIC PAPERS.

THE LITERATURE OF FURCRAEA WITH A SYNOPSIS OF THE KNOWN SPECIES.*

BY J. R. DRUMMOND.

Furcraea geminispina, Jacobi.

The type of this, as Dr. Trelease has remarked, was a single specimen seen at Kew about October, 1865,† by General von Jacobi, which had not flowered, but was otherwise well developed (Versuch, Sep. Abdr. p. 282). Jacobi also referred to this type certain young plants in the Berlin Botanic Garden, which had been received through a Herr Meyerhoff from St. Domingo; and he further stated his belief that the species was identical with the second variety of "*F. tuberosa*, Willdenow" (*i. e. Agave tuberosa* of Sp. Pl. ed. 1799, ii. i. 194). Willdenow, however, merely cites the Hortus Kewensis (1789) which gives under *Agave* two species referable to the modern genus *Furcraea*, viz. 5, *A. tuberosa* and 6, *A. foetida*. No. 6 is manifestly intended for the plant described (in 1793) as *Furcraea gigantea* by Ventenat, but we do not know whether

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* The following epitome of our present knowledge of the genus *Furcraea* has been prepared in connection with an investigation undertaken at Kew by Mr. Drummond, last year, to account for the types of certain species ascribed to the Kew Gardens concerning which I had inquired, and is of such general interest that, with the accompanying illustrations, it is published with the concurrence of Colonel Prain, the Director of the Royal Botanic Gardens at Kew, who as well as Mr. Drummond has long been interested in the genera *Furcraea* and *Agave*.—W. T.

† For this date and other assistance the writer desires to thank Mr. S. A. Skan of the Kew Herbarium.

the plant grown at Hampton Court in 1690 was in fact the plant of Ventenat. As regards no. 5, the text of the Hortus Kewensis is as follows:—

"5. A. caulescens, foliis dentato-spinosis.

α spinis solitariis. *Agave tuberosa*. Mill. dict. Single-spined tuberous-rooted Agave.

β spinis duplicibus. Double-spined tuberous-rooted Agave. Nat. of America. Cult. 1739, by Mr. Ph. Miller. Rand. Chel. Aloe 34."

A note is added that this species and the one preceding it there (*Agave lurida*) are doubtful, the fruit being unknown. In the 1811 edition of the Hortus Kewensis (ii. 302–303) these two species are reproduced under *Furcraea*, with a slightly expanded synonymy, but the former note is expunged, and a fresh observation is inserted, relating solely to *F. tuberosa* and stating that the flowers of *F. tuberosa* are the size of the flowers of *F. gigantea*, and twice those of its congener, *Agave cubensis*, Jacq.

By 1811 therefore there were four Furcraeas known at Kew; but only two of these were actually cultivated in the garden, and those two were looked on as merely forms of a single variable species; thus,

1. *Furcraea gigantea*, Vent.
2. *Furcraea tuberosa*, *Ait.**
3. *Furcraea tuberosa*, spinis duplicibus.*
4. *Furcraea* (*Agave*) *cubensis*, Jacq.

The next question is whether the *Agave vivipara* of Aiton represents a fifth *Furcraea*, as from the original Linnaean description should evidently be the case. In both editions of the Hortus Kewensis *Agave vivipara* is referred to Aloe no. 7 of the first edition of Miller's Gardeners' Dictionary, which Miller himself identified with *Aloe sobolifera* (of Hermann), a West Indian Eu-Agave, and most likely the same as *A. antillarum*, Descourtilz. If, as seems probable, the plant actually grown at Kew was Hermann's *Aloe sobolifera* then

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* Represented in the garden.

the further citation of Willdenow's *Agave vivipara* was quite erroneous, because the specimen in Willdenow's Herbarium, which the writer has been enabled by the courtesy of the Berlin Museum Staff to inspect, is most plainly a *Furcraea*. The older botanists did not know that bulbils are produced by all, or almost all the species of Eu-Agave and *Furcraea*, so that every specimen which displayed this feature was referred to as "vivipara" with well nigh interminable confusion as the consequence. *Agave vivipara* of Miller's eighth edition was perhaps a *Furcraea;* it will be considered later. What "*Agave vivipara*" tab. 180 of the Plantes Grasses may represent, the writer is unable even to conjecture; it seems hardly to be either a *Furcraea* or an *Agave*.* *Agave vivipara* of Wight (Ic. 2024) is an Eu-Agave, for which Col. Prain and the writer in a note † on the Agaveae naturalized in India have proposed the name of *Agave Wightii;* this appears to be a native of the Antilles and is quite distinct from the species recently in growth at Kew under the same name which is *Agave Cantala*, Roxb. (Rumpf, Herb. Amboin. v. t. 94) = A. *vivipara*, Baker in Gard. Chron. n. s. viii. (1877), p. 780, excl. all syn. but Wight, but not in Kew Bull. no. 39, March 1890, cxxxv.

Returning now to *Agave tuberosa*, it is evident that Miller's plant was the "Aloe americana tuberosa minor spinosa. Parad: Batav: Prod:" of the Hortus Amstelodamensis ii. Cap. xix. fig. 19, as indeed is expressly stated under Aloe 34 by Isaac Rand, in the Index Hort. Chels. 1739 (cited by Aiton), a rare work to which the writer has had access through the kindness of the authorities of the Natural History Branch of the British Museum. Miller makes no allusion to the "twin-spined" form of *tuberosa*, and an examination of both living and herbarium examples has convinced the writer that this feature is neither confined to any single species nor constant even in the individual. In *Furcraea tuberosa* the leaf margin is sharply indented, the rather close set prickles forming each

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* Cf. however, Todaro, Hort. Panorm. ii. pp. 51–54. tt. xxxvii–xxxviii.

† Govt. of India Agricultural Ledger. 1906, no. 7. (Veg. Prod. Series no. 99.)

a horn to the intervening crescent-shaped indentation, but the breadth of the indentation varies widely, and sometimes, in the young state especially, the space which should intervene between adjacent prickles is suppressed more or less completely so that the bases of the prickles coalesce or approach each other closely; as Commelyn puts it in describing the leaves "eorum margines spinis viridibus nullo servato ordine armantur."

It is not so clear what is meant by the initial character "Radicem habet haec Aloe tuberosam una cum fibris rubicundam . . ." From the corresponding part of the description (Cap. xviii.) of "Aloe americana viridi rigidissimo et foetido folio piet dicta indigenis. Kiggelarii Hort: Beaum." it would seem as if the actual roots were "tuberous," but this is not borne out by the figures; and from Miller's text it appears that in his time, the "tuberous root" of the old authors was understood to have referred to the true stem or caudex. On the other hand Tussac, who had many opportunities for studying the plant which he deals with as *Furcraea gigantea* (Fl. des Antilles, 1818, vol. ii. pp. 101–103) in the living state in S. Domingo, says that it has "un faisceau de racines en partie tubéreuses et en partie fibreuses." His description plainly indicates *F. tuberosa*, Aiton: the plant grew "wild" in several cantons of the colony, and produced the "filasse qu'un nomme pitte;" but Redouté's illustrations which accompany the text are exactly copied from nos. 126 and 126 (bis) of the Plantes Grasses (1799) to which is appended a description of *F. gigantea* taken, as De Candolle was careful to explain, from Ventenat. This figure differs materially from Redouté's no. 476 in vol. viii. of the "Liliacées," also styled *F. gigantea*, which agrees, though not perfectly, with Jacquin's colored figure of *Agave foetida* in Ic. Pl. Rar. ii. t. 379, and his description in the Collectanea, ii. 312. In all these figures, as in Commelyn's no. 18, the leaf-edges are devoid of prickles, whereas Ventenat (Bull. de la Soc. Philomatique, no. 28 Vendemiaire, an 2 de la Rép. — Oct. 1. 1793, republished in 1796 at pp. 54–60 of Usteri, Annalen, vol. xix) gives the leaves of *F. gigantea* as "dentato-spinosa, dentibus planis, raris, remotis, rubicundis."

There is a *Furcraea* naturalized in the Sibpur Botanic Garden which appeared to Col. Prain and the writer to be the true *gigantea* of Ventenat, and in this the leaf is sometimes quite devoid of margin prickles, sometimes there are "teeth" on one margin only, or a few weak "teeth" are present at the base of the leaf-blade somewhat as in Wight's Icon. 2025 which is named *F. gigantea*, but may represent a different species. The Calcutta plant appears to be represented at Kew by a few young specimens, but at the stage reached it is not easy to distinguish the true *gigantea* from the form described by Baker at 6543 Bot. Mag. as *F. cubensis*, Haw. var. *inermis*, which seems to be very like Redouté's picture in the Plantes Grasses of *F. gigantea*, repeated in Tussac's Flore des Antilles, as already stated, for what was really *F. tuberosa*, and again by Trattinick with a translation from the description in the "Liliacées" of the true *gigantea*.

The living plants of *F. cubensis* at Kew are rather young for satisfactory determination, but in the Herbarium there are specimens which the writer takes to represent the genuine *Agave cubensis* of Jacquin, notably no. 3250 of C. Wright's Plantae Cubenses. In this form the perianth is smaller and the germen shorter than in *F. gigantea*, agreeing with a sheet of *A. cubensis* from Jacquin's herbarium at the British Museum which consists unfortunately of a solitary flower, and with the dissection given at fig. 28, tab. clxxv. Sel. Stirp. Amer. (descr. at p. 100); the leaf is more gradually constricted above the base than in *gigantea*, and the margin prickles are more regularly set, and proportionally smaller than in *tuberosa;* they are slighter and less uncinate than in *F. Selloa*, to which, rather than to *F. cubensis*, we should probably refer *F. Lindeni*, if indeed this should not be looked on as a valid species. *F. cubensis* seems to be restricted to Cuba, in the islands at all events.

We have seen that Aiton's "*tuberosa* spinis duplicibus" was in all likelihood the equivalent of Tussac's plant from S. Domingo, but the Kew variety with simple spines remains to be accounted for.

In the Gardeners' Chronicle n. s. xi. (1879) p. 624, Mr.

Baker remarked that we have no published figure of *F. tuberosa*, Aiton. He might have said that there is no figure published or unpublished, except the original 19 of the Hortus Amstelodamensis, because the unpublished drawing sent to Kew by Fenzl mentioned by Mr. Baker does not belong to *F. tuberosa:* Mr. Baker himself subsequently referred this plant to *F. undulata*, Jacobi, but in any case it was clearly not *F. tuberosa*, Aiton. In the "Amaryllideae," p. 200, it is stated that no reliable specimens are available; but there is a sheet at Kew from the Goodenough Herbarium marked as "*Agave tuberosa*, Hort. Kew. genus novum," with the note "This flowered for the first time in Europe at Kew October and November, 1793," etc. Mr. Baker named it first "*Fourcroya tuberosa*, Ait. type," but corrected this in pencil afterwards to "*F. gigantea*, Ventenat." So far as the material goes, the writer cannot help thinking that the earlier determination was correct, and that we have here the type of Aiton's species, which is hard to distinguish in the dry state from some forms of *F. gigantea*, Vent. though the living plant should be readily distinguished.

Stress has been laid on the odor of the flowers, but the trivial name given by Linnaeus had no reference to that, but to the smell from the crushed leaves of *F. gigantea*, which in Calcutta specimens was most perceptible; as Commelyn says of *tuberosa*, "Caeterae, quas possidet qualitates, cum priore [*F. gigantea*] conveniunt, praeterquam quod haec Aloe non foeteat." Of the preceding (Cap. xviii.) he writes "Ipsis foliis succus quidam adhaeret viscosus & foetidus."

Boerhaave (Index Hort. Lugd. Bat. 1720) says of Hermann's plant, which is that of Commelyn's 18th chapter and figure, "Nascitur in Curaçao unde fila parantur sutoribus quae ibi Piet vocantes inde nomen dederunt plantae." Redouté in the "Liliacées" gives the home of *F. gigantea* as "Curaçao and S. Domingo;" the former rests no doubt on the Leyden Catalogues, and the latter may be safely traced to Tussac, but the species is wrongly given, for the S. Domingo plant described in the "Flore des Antilles," and afterwards received through Mr. Meyerhoff in the Berlin Garden, was,

the writer cannot doubt, *F. geminispina*, Jacobi, = *F. tuberosa*, Aiton.

Jacobi's type has doubtless meantime perished, but there is a plant now at Kew which answers unmistakably to the description of "*geminispina*," and this appears to the writer to be identical with a specimen in the Herbarium collected for the brothers Smith in the Island of Bequia (one of the Grenadines) south of St. Vincent. Both no doubt are the same as a *Furcraea* sent in 1892 by Mr. C. A. Barber from Antigua with an illustrative set of photographs, a brief description of the plant, and a drawing of the flower, which is at once distinguishable from its allies by the proportionately longer germen, a feature which is obvious in the Goodenough Herbarium type of *Furcraea tuberosa*. There are examples in the Kew Herbarium from Nevis and Grenada also.

The earliest mention of the Agaveae by any European writer occurs in a work published at Basle in 1533, where the "Maguey" of San Domingo is likened to a palm*, and the name is said to have signified, in the Haitian tongue, a drum or cymbal. Martius believed that the Haitian drums were made from sections of the scape of the Maguey, but however this may be there is every reason to suppose that the original Maguey was not any *Agave* at all but the *Furcraea* which our present information shows to be common, if not dominant, in several of the Leeward Islands group, and was brought to Berlin, as Jacobi states, from S. Domingo, his *geminispina* namely, *i. e.*, *F. tuberosa*, Aiton. None of the West Indian Agaves has a trunk except *A. Wightii*, which appears to have a different distribution, and in any case that has not the characteristic "palm-like" habit of *Furcraea tuberosa*.

It has been stated (Dr. K. Braun in "Pflanzer" no. 14, Sept. 29, 1906) that the earliest account of any *Agave* is that given by Oviedo, "Commandeur von St. Domingo," in the Hist. Gen. de las Ind. (Seville 1535) in which it is mentioned that the people of Araya are called Magueyes from the abundance of the Maguey plant in their country. Von Mar-

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* Decades, Cologne, ed. 1574, p. 301, quoted by Martius.

tius (Beitrag zur Nat. and Lit. Gesch. der Agaveen, 1855, pp. 9–13) has discussed the early accounts very fully, pointing out that in Oviedo's earliest work (published 1526), and in the first edition of the "Coronica," (Seville 1535), there is no mention of the Maguey. Oviedo's notes on "Cabuya" and "Henequen" were promptly published, but Maguey remained in manuscript until 1851, when the uncompleted portion was first published by the Madrid Academy, and this has obviously helped to keep up the impression that our knowledge of the Agaveae and the name "Maguey" originated from the continent of America, whereas, even if the later date which the writer has adopted for Peter Martyr's mention* be taken, it is certain that the Maguey was first met with in the Islands. Martius observes that the dedication of the first "Decade" bears date October, 1516,—that is before the discovery of Mexico.

Oviedo speaks of the Maguey of the Antilles from his own knowledge; what he says of Araya and the Maguey of the mainland was from hearsay apparently. Araya is a port in what is now Venezuela, at the western extremity of a long narrow peninsula which, running parallel to the coast lying east of Cumana, forms the deep inlet marked in Keith Johnstone's Royal Atlas (1898) as the Gulf of Cariaco.

The "Maguey" Indians do not seem to be recorded in that neighborhood by modern writers, but a "Mangue" nation or confederacy was at one time in the ascendant in the country between Yucatan and the Northwestern Andes. It is shown by Don An. Alfaro (Boletin de la Sociedad Nac. de Agricultura [Costa Rica] no. 6, Aug. 25, 1906) that in 1529 Oviedo visited the Gulf of Nicoya (on the Pacific Coast of Costa Rica), where he witnessed (and afterwards described) the preparation of cordage from two plants, which he calls "Henequen" and "Cabuya," the Cabuya, from the descriptions, being evidently a *Furcraea*. Mr. T. A. Sprague, F.L.S., has most kindly placed at the writer's disposal his collection of works on

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* Decades, of Peter Martyr (translated in Hakluyt's Voyages, 1598), Repr. Lond. 1812. Dec. iii. Cap. 7 [p. 289 Repr.] and Cap. 9 [p. 299 Repr.].

natural history, products, and travel in Colombia and the adjoining countries, from which it appears that Cabuya is the term commonly applied throughout that region to the species of *Furcraea*, but in parts of Colombia "Fique" is also used. The "Cocaiza," or "Maguey de Cocuy" (there are several other forms and spellings) of Venezuela is more doubtful; at Caracas and Cumana "Maguey de Cocuy" is expressly said on the authority of Humboldt (Nov. Gen. et Sp. i. p. 289, an. 1815) to be *Yucca acaulis*, HBK. which as Dr. Trelease has shown* was in reality a *Furcraea*.

Our information as to the Agaveae of South America is as yet imperfect. Specimens from the Cauca Valley (inland Colombia) of the local Cabuya seem to be *Furcraea gigantea*, and it was most likely the same plant which M. Ed. André found being worked up for cordage at Venta Quemada between Cartago and Naranjo ("L'Amérique Equinoctiale" in Tour de Monde, 1877, p. 116). Triana's specimen marked "Fique or Cabuya" from the mountains towards Bogota, about 9,000 feet above sea level, is an unknown species of *Furcraea;* whereas "Pita" in the Andes seems to be commonly reserved for one or more local species, probably not yet described, of *Agave*.

Matters have been complicated by the lax and shifting use in different parts of South and Central America and in the West Indian islands, of certain local or venacular expressions, *e. g.* "Silk-grass," "Karatas," "Keratto," "Caraguata," and "Istle" (often written, Spanish fashion, "Ixtli"). "Caraguata" ("Caroata," "Grawatha," or "Karuata") seems to be current chiefly in the upper Amazon and Orinoco basins, and applied originally perhaps, as it certainly does now, to various Bromeliaceae, but it has come to be attached, in the Antilles at least, to one or more of the Furcraeas. "Karatas" has a similar history, but in this case the application to a *Furcraea* has arisen perhaps from a compiler's blunder. "Keratto" (or "Coratoe") in the Western Antilles is unquestionably a yellow-blossomed Eu-Agave allied to

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* Rept. Mo. Bot. Gard. xiii. 114. (1902).

A. antillarum, Descourtilz, if not actually that species, but this title also has been sometimes transferred to a *Furcraea*. "Istle" would take up a treatise almost by itself, but *Furcraea* seems, as a rule, to have escaped its visitations. In Jamaica "Silk-grass" (see Long, p. 814) meant,—or at all events included,—a true *Aloe* introduced through the Bermudas, as it was supposed, from Africa; in the Eastern Antilles it seems to denote *Furcraea tuberosa*.

In a Supplement to the Leeward Islands Gazette of the 20th July, 1893, Mr. C. A. Barber, F.L.S., reported on the "Silk-grass," "Silk-Dagger," or "Sweet Dagger" of which he had sent dried specimens in 1892 to Kew from Antigua (identified by the writer, as above explained, with F. *tuberosa*, Ait. fil.), and in this report the plant is noted as occurring also in St. Kitts, Montserrat, Nevis, and Dominica, but in the last, doubtfully indigenous; Mr. Barber had heard of it in Tortola (Virgin Islands), and thought that it probably extended to Barbuda also. These Antigua specimens were referred at Kew to *Furcraea gigantea*, Vent. var. *Willemetiana* (Roemer Syn. iv. p. 293) which is nothing but a book equivalent for the *Funium pitiferum* of Willemet ("Herbarium Mauritianum" in Usteri, Annalen xviii. 1796), naturalized for the sake of its fiber in the Isle de France, and from the description should be F. *gigantea*, Vent. Roemer gives San Domingo as a chief habitat of his "*gigantea*" (type), so that he has evidently just inverted the geography, for the true *gigantea* is the mainland, not the island form. This was partly due, no doubt, to Ventenat's description which in part applies more precisely to *tuberosa* than to Commelyn's no. 18, but the rest of the account indicates the Curaçao species of the Dutch authors unequivocally. Very likely writers on the "Aloes vert" of the Mascarene Islands have at times confounded different introduced Agaveae; and *F. tuberosa* may have found its way to the Mauritius even in the time of Aublet, whose West Indian names belong primarily, so far as the writer knows, to *tuberosa*.

In 1891 Mr. Bovell sent to Kew from Barbados two sets of dried specimens of what seems to be a single species of *Fur-*

craea; one set was said to have been "found growing in the Scotland District," the other was perhaps from a Botanic Station Garden. These were referred (as the Antigua plant was later) to "*F. gigantea* var. *Willemetiana,*" but they seem to the writer to be referable to *F. tuberosa;* the indentation of the leaf-margin is obscured or obliterated, but from Mr. Barber's description (which includes a sketch of "intervals" on the leaf-edge) this seems to occur in *tuberosa;* in many Agaveae, indeed, such characters depend on the stage of individual development. In a British Museum copy of the Hortus Elthamensis (1732), which has colored illustrations, figure 21, tab. xix. of "Aloe barbadensis mitior, laete virens et splendens" is unmistakably intended, in the writer's view, for *Furcraea tuberosa:* the text also, which contrasts this sort of "Aloe" with "the common American" and the "Vera Cruz" kinds, fits *F. tuberosa* precisely, with the single exception that the plant of Dillenius is credited* with a brown "aculeus," (ultimately black), above the convolute and pungent leaf-tip, which, in leaves of *tuberosa* at their prime, is not ordinarily observable; in individuals there is not unfrequently an apparent spine, above the apparent leaf-tip, but this character in *Furcraea* generally is unsatisfactory, often transient, and of little moment. In the list of names prefixed to the issue with uncolored plates by Sherard, in which the Dillenian titles are reduced to Linnaean binomials, the plant, which was brought to England from Barbados by "Mr. Newport Merchant of London," is reduced to "*Agave americana,*" though the letter-press ought to have precluded this confusion. Strictly speaking, this is an early figure of *F. tuberosa,* but as Commelyn's illustrations and the previous literature are ignored, it can hardly be said to conflict with the dictum above quoted; and the like applies to Gartenflora, i. (1852) Taf. iii. p. 21 (in O. Heer's article "Der Renton Garten in Funchal"), which though pretty certainly based on a specimen of *F. tuberosa* is named "*gigantea*" and referred by

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* Owing, possibly, to confusion with "*Agave Morrisii,*" the young leaves of which are not dissimilar.

Regel, following Roemer doubtless,—to var. *Willemetiana*. A modern figure in Revue Horticole, 1877, p. 234, which professes to be *F. tuberosa*, might be any of this group of species.

The distribution of this group seems to be approximately as follows:—

(a) *F. gigantea*, Vent., from Costa Rica to Northern Venezuela and again on the east coast of Brazil to about the 25th south parallel; S. E. Antilles, but doubtfully indigenous; inland Colombia (probably an introduction).

(b) *F. tuberosa*, Ait. fil., Haiti and Santo Domingo; Puerto Rico; Lesser Antilles (doubtfully indigenous).

(c) *F. cubensis*, Vent., Cuba; Yucatan (in cultivation).

There is a specimen in the Kew Herbarium from the Demerara Botanic Garden (Jenman no. 3887) marked at Kew "*F. gigantea* var. *Willemetiana*" which resembles one of Bovell's Barbados sets, and is probably cultivated *tuberosa*.

On the other hand *F. gigantea* is represented from the French Antilles, but it was brought there in the first place, the writer suspects, by human agency. Even in Colombia, in the south at least, the "Cabuya" has been probably brought from the Isthmus; at Popayan, above the head waters of the Cauca, it is expressly stated that the Cabuya, though abundant, has been planted. The headquarters of the genus lie evidently in the mountains sloping towards the Pacific coast from Oaxaca to Darien, and as pointed out by Mr. Hemsley (Biol. Cent. Amer. Bot. App., p. 272) the *Furcraea* area extends to the southwards while the Agaves have their maximum development towards North America.

F. tuberosa as a spontaneous product seems to be restricted to the islands eastwards of Jamaica and north of Tobago (in Jamaica itself the genus seems to be entirely wanting except as an escape). It is probably the "[Aloe] eadem portoricensis foliis non foetidis minusque rigidis" [*i. e.* less than in *F. gigantea*] "radice tuberosa, an Aloe americana radice tuberosa, non foetida P. B. Prodr." of the Hortus Beaumontianus (1690); but it may have been originally endemic in Hispaniola.

Seemann's "*tuberosa*" from the Isthmus was no doubt

gigantea; a specimen of his gathering at the British Museum marked "vulgo Cabuya, Panama" is, the writer thinks, true *gigantea*,—in any case it certainly is not *tuberosa;* this is probably the same as no. 973 of p. 216, Botany Voy. of the Herald, "on the slopes of the volcano of Chiriqui, Veraguas, but also cultivated to a considerable extent on account of its fibre . . ."

F. gigantea is recorded from several of the small islands fringing the gulfs of Panama, of Darien, and of Maracaybo, from the Magdalena littoral and the delta of the Orinoco; but for Trinidad the writer has little information, while Tobago has a *Furcraea* literature of its own, as follows.

In 1648 Jan de Laet edited a work of Willem Piso on Brazilian Medicine and in this (De Medic. Lib. iv. p. 112 et fig. ad. rect. lat. p. 111) is described a Brazilian Caraguata distinguished as "Caraguata magna" or "Caraguata guaçu" [i. e. "Karuata assu" or giant Karwata]. From the description this was manifestly a *Furcraea*, but in the woodcut the flowers are erroneously drawn with but five segments, and later authors who relied on this to fill out their matter have described the "corolla" as five-petalled accordingly. This work of Piso's is prefixed to the posthumous Historia Rerum Naturalium Brasiliae of Georg Marcgraf of Liepstad* in which (Lib. ii. pp. 87–88) the following kinds of Caraguata are distinguished (besides the true Aloe which had been discussed in a former chapter), viz. (1) Caraguata growing on tree trunks, etc., probably a *Bromelia* or *Karatas;* (2) Caraguata-guaçu, also a Bromeliad, possibly an *Aechmea;* (3) Caraguata açanga, the Penguin (*Bromelia Pinguin*, Linn.); but to this De Laet appended an account borrowed from Ximenes' edition of Hernandez' four books on the medicinal products of New Spain (1615) of sundry kinds of "Metl," and also a rude figure taken from a sketch, provided by a friend who had lived in Tobago, of a plant which De Laet supposed to be the same as the "Nequametl" of the Spanish author. From the woodcut in Hernandez (Ed. Nardo Recchi, "Nov.

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* Near Dresden in Saxony: he called himself "Misnicus" i. e., of Meissen.

Thesaurus, etc.," 1654, p. 273) of Nequametl it is clear that De Laet was in error, for that was probably an *Agave* of the Littaea section, and in any case remote from the Tobago species which, if anything, resembles Todaro's *Furcraea elegans*.

In his 1658 edition of Piso, De Laet gave in all five Caraguatas, viz:—

(i) Caraguata açanga which is *Bromelia Pinguin*, Linn.; (ii) Caraguata guaçu, by description evidently Marcgraf's plant of the same name, which was a Bromeliad, but the corresponding figure is the Caraguata-guaçu of Piso (de Medicinis) *i. e.* a *Furcraea;* (iii) the "Erva babosa" of the Portuguese and a true *Aloe;* (v) by the description should be a *Karatas* of the Nidularium group in that genus; while (iv) reproduced Marcgraf's figure of his original Caraguata-guaçu, with a brief description differing from Marcgraf's which, as just seen, had been transferred to Piso's Caraguata guaçu. It is not easy to trace the original Caraguata guaçu (*i. e.* Marcgraf's) but it may refer to the *Tillandsia augusta* of Velloso (Fl. Flum. iii. t. 135, 1827) cited doubtfully by Martius (Fl. Bras. iii. pt. iii. pp. 568–569, tab. 105) for his *Vriesia imperialis*, E. Morr. ined., and identified by Baker (Journ. Bot. 1879, p. 162) with his own *Aechmea augusta*, which, however, seems to be a separate though perhaps closely allied form (*cf.* also Gaudichaud, Voy. Bonite, 63).

Linnaeus, in the Hortus Cliffortianus (1737), p. 130, cited "Marcgraf, Bras. 87" for his "Aloe foliis lanceolatis dentatis spinosis spinâ cartilaginea terminatis radicalibus" which for the rest is the *Agave americana* of the Species Plantarum. He was thinking possibly of *Agave antillarum*.

Labat (Nouv. Voy. aux Isles, etc., 1724, pt. 4, chap. xvi. p. 115) gives a long account of "Karatas," largely based, though without acknowledgment, on De Laet's description of the Caraguata-guaçu, but the figure of Karatas (reduced from Piso's Caraguata açanga) opposite p. 135 of the first part is *Bromelia Pinguin*, Linn.; opposite p. 69, however, of part 4, there is an artistic reproduction of De Laet's Tobago "Nequametl" entitled "Aloes ou espèce de Karatas qui a fait son

jet et fleury dont on fait le Tol;" finally he says the leaves of the Karatas yield an excellent substitute for soap. So far as the French Antilles were concerned this no doubt refers to *Furcraea tuberosa*, or *F. gigantea*, and *Agave antillarum*, the points taken from the Jamaican Penguin and the Tobago "Nequametl" being literary embellishments; but unfortunately Jacquin, in the Sel. Stirp. Am. (p. 100), quoted Marcgraf's Nequametl as a synonym of his *Agave cubensis*, and this, taken with Labat's story, which was given currency by Martius (under "*Fourcroya cubensis*" l. c. p. 189), has led to the perfectly erroneous supposition that *Furcraea cubensis* is diffused in the Lower Antilles and the northern parts of South America. Labat's errors were not altogether original, for Du Tertre (Hist. des Antilles, ii. 106, quoted by Koster, Travels in Brazil, App. p. 482), had the same legend of the Karatas though in a rather simpler form. Martius seems to have been influenced by the "Dissertação sobre as plantas que podem dar linhos, etc." (1810, pp. 23–26) of Arruda da Camara, who describes the "Caroata assu" or "Piteira" and identifies it with "*Agave vivipara;*" but whether the Linnaean species is meant, or some other, is not evident. It may be doubted whether the author had before him any actual plant, and was not merely dealing with the Caraguata guaçu of the early writers. Local botanists should be able to discover what De Laet's Tobago drawing represents; it could hardly have been *Furcraea cubensis* or *F. gigantea:* and considerable interest attaches to the identity of the Agaveae of this island, with regard to its geographical position.

It has been suggested that *F. gigantea* is not really separable from *tuberosa*, but the plants at their prime appear to be readily distinguishable in the living state, though it is not easy to find tangible book characters; they differ in habit, in the outline of the leaf, and by the perianth; the odor of the crushed leaf cannot always be observed, and but little weight attaches to the leaf margin as between them. It has been stated that *F. gigantea* has a stem, while *tuberosa* is comparatively stemless: this character, as with several other Agaveae, is of slight value, but in point of fact old plants of *tuberosa*

seem in most cases to develop a stout, often twisted or partly decumbent, caudex up to five feet long or more. *F. Lindeni* has a usually straighter, somewhat slighter trunk, with more numerous leaves, arranged in a more symmetrical and closer spiral; the leaf is rather narrower in proportion to its length, stiffer, with the margin firmer and prickles less irregular; the under surface of the leaf moreover is rougher; the inflorescence is not known to the writer and in its absence *Lindeni* seems doubtfully distinct from *Selloa*. *F. gigantea*, *tuberosa* and *Selloa* are perfectly distinct from *F. cubensis*, which should probably be placed in a group by itself and apart from the "Giganteae." The confusion has been increased by Jacobi's having cited *F. tuberosa*, Ait. *β* under *F. cubensis*, although he had already quoted for his "*geminispina*" (*i. e. tuberosa*) "Willdenow Sp. Plant. p. 194," which is merely a quotation from the first edition of the Hortus Kewensis, concerning the second sort of "*Agave tuberosa*." Jacobi notes that he had never seen a plant answering to Jacquin's description of *Agave cubensis*, unless perhaps one in an Exhibition at Amsterdam, and that, from the description, does not seem to have been really *Furcraea cubensis* which, as accurately said by Jacquin, has the leaf margin "ciliato-spinose" as against "dentato-spinose" in the language of the older botanists. The leaf of the true *cubensis* is distinct in color, texture, thickness, outline and by the margin from all known *Furcraeas* but the doubtful "*albispina*," being more like that of certain Eu-Agaves, notably the young state of *Agave Wightii*, Drummond and Prain (see p. 27 above). When our notes on the naturalized Agaveae of the East Indies were sent to the press we had not seen Wright's Cuban specimens, or Barber's Antigua *tuberosa*, so that references in that memoir to *Furcraea cubensis*, and *F. Commelyni* must be taken accordingly; it seems possible that some of the "Mauritius hemp" now grown in the Mascarenes and in S. India is really *Furcraea tuberosa*.

About twenty species of *Furcraea* have received names of varying authority, but of this number only about ten can be said to be established, and of these *F. elegans*, Hort. Panorm.

i. p. 13, t. 4, is known solely from the figure and description of Todaro, but is given a place among the admitted species for reasons stated in the subjoined provisional classification, to which is appended a key to the group of "Giganteae." In this scheme an "x" in brackets is placed against those species that are understood to be represented now at Kew by living examples.

The synonymy, which is often both obscure and intricate, is not given under the species but is dealt with by itself; and notes are given on imperfectly known species, also names to be excluded.

Conspectus.

Furcraea, Ventenat in Bull. Soc. Philomat. no. 28 (Oct. 1793), reprinted in Usteri Ann. xix. (1796) pp. 54–60; Haworth, Syn. (1812) p. 73; Baker, Amaryllideae (1888) p. 198; Baillon, Hist. des Plantes (1894) xiii. p. 64.

Furcroea A. P. De Candolle (after 1806), Plantes Grasses no. 126; Ait. fil. in Hort. Kew. ed. 2 (1818) p. 302; Bot. Mag. 2250 (1821); Benth. & Hook. fil., Gen. Pl. (1883) iii. 739; Hemsley, Biolog. Cent. Amer. (1884) iii. 352.*

Furcroya Rafinesque-Schmaltz, Somiolog. (1814) p. 31; Endlicher, Gen. (1837) i. 181.

Fourcroya, Sprengel, Anleitung ed. 2 (1817) pt. ii. p. 238; Zuccarini in Nova Acta Acad. Leop. Car. xvi. (1833) pt. ii. 664; Herbert, Amaryllidaceae (1837), 57, 69, & 126–7; M. J. Roemer, Syn.(1847) iv. 21, 292; Ft. zu Salm-Dyck in Bonplandia vii. (1859) pp. 85–87; Jacobi, "Versuch etc." in Hamb. Zeit. xxi. (1864); Baker in Gard. Chron. (1879) i. 623.

Fourcroea Haworth, Supplem. (1819) p. 42.

Funium, Willemet, Herb. Maurit. in Usteri Ann. (1796) xviii. p. 26.

Roezlia, Hort. (non Regel).

Sect. I. Serrulatae.

Leaf margins closely set with minute teeth; trunk conspicuous, sometimes arborescent.—Subgenus Roezlia, Baker in Amaryllideae, 1888, p. 199.

1. **F. longaeva,** Karwinski & Zuccarini in Nova Acta Acad.

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* Tab. 89–92 of the Biologia belong to *Dioscorea*, and not, as stated by a clerical error in Baill., *l. c.*, to *Furcraea*.

Leop. Car. (1833) xvi. 2, 666, t. 48; Bot. Mag. 5519 (1865) (*Fourcroya*).

Hab. Among oak and arbutus thickets on the slopes of Mt. Tanga, Oaxaca, Cent. America, about 10,000 ft. above sea, Baron Karwinski; lofty ridges in Guatemala, Skinner, f. Bateman in "Orchidaceae" (1843) letter press to tab. xvi. (*Brasavola glauca*), with vignette illustration; near Sorata on Illampu, Andes of Bolivia, alt. 9,000 ft. above sea, Mandon no. 1192 in Hb. Kew. (perhaps an undescribed species closely allied to *longaeva*).

2. F. Bedinghausi, K. Koch in Wochenschrift (1863) vi. 234; Belg. Horticole,1863, pp. 327–330 with figure; Bot. Mag. 7170 (1891) (*Fourcroya*). [x]

Hab. Mt. Acasca near the city of Mexico, Roezl 1860, f. Bot. Mag. l. c.; Pedregal, Pringle no. 6801; Sierra de Pachuca, do. 6991, both in Hb. Kew.; Serrania de Ajusco, do. 6669 (ident. not quite certain) in Herb. Kew.!

Sect. II. Spinosae.

Leaf margin armed with conspicuous more or less distant prickles (prickles occasionally few or obsolete); trunk under six feet high, often undeveloped.—Subgenus Furcraea proper, Baker l. c.

Group A. Minores.*

Mature leaf less than forty inches long; scape (with panicle) fifteen feet or under.

3. F. undulata, Jacobi in Abhandl. Schles. Gesellsch. 1869, p. 170; Bot. Mag. 6160 (1875) (*Fourcroya*). [x]

Hab. unknown; Jacobi conjectured it might have been collected (for Verschaffelt) by Ghiesbrecht in Chiapas or Tabasco (Eastern Mexico); "Bermuda" f. Hort. W. Bull. (1878) in Herb. Kew.!; New Providence Island (Bahamas) vern. "Manilla," Eggers no. 4194 (ident. doubt.) in Hb. Kew.!

4. F. albispina, Hort. Panorm. ex Baker in Gard. Chron. (1893) xiv. p. 584.

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* Cf. Jacobi, Nachtrag p. 174 sub *F. Aitoni* ("e minoribus congenerum").

Hab. unknown; a doubtful plant, the leaf margin somewhat recalling that of *F. cubensis*, Vent., but the perianth lobes longer in proportion.

Group B. Giganteae.

Mature leaf more than forty inches long; scape (panicle included) fifteen feet high and over (attaining 30 feet).

5. F. cubensis, Ventenat in Bull. Soc. Philomat. Vendemiaire an 2 de la Rép. (= 1 Oct., 1793).

Hab. Cuba: elsewhere probably introduced. C. Wright Pl. Cub. no. 3250!; ex Hb. Jacquin. in Hb. Mus. Brit. (flower only)!; Hb. Morales, f. Canizares, Flora Cubana (Habana 1901); Cienfuegos, Prov. Santa Clara no. 297, R. Combs in Trans. Acad. St. Louis, vii. 470; "vern. cajuin, Cajun Maya, near Sisal, [Yucatan] cult.", Schott no. 809 in Hb. Mus. Brit. (ident. not positive)!; vern. cahum-ci, Yucatan f. E. Mairaux* in "Revue Américaine" (Brussels) 15 April, 1904; vern. "Manila", East Caicos Island, f. Kew. Bull. 1890, pp. 274–276 (ident. doubtful).

6. F. tuberosa, Ait. fil. in Hort. Kew. ed. 2 (1811) ii. 303. [x]

Hab. S. Domingo, Tussac Fl. des Antilles (1818), ii. pp. 101–103 (desc. in French of *tuberosa*, with fig. of "*F. gigantea*, Vent." copied from De Candolle, Hist. Pl. Succul. no. 126, and name "*gigantea*"); also Meyerhoff, f. Jacobi, Versuch, etc. (Sep. Abdr. 1864–67), p. 282, sub "*geminispina*"; Puerto Rico (v. P. Hermann in Par. Bat. Prodr. 1688, sub. tit. "Aloe americana, etc. . . . portoricensis"; also Sintenis no. 482, A. A. Heller et conj. no. 317 (both flowers only and ident. doubtful) in Herb. Kew.!; Virgin Islands, R. H. Schomburgk ex Martius (Beitrag, etc., p. 42) sub nom. "*Agave americana*" (?); Tortola (?) C. A. Barber; St. Christopher, Barber; Nevis, J. Briggs in Hb. Kew.!; Montserrat, Barber; Antigua, Barber!; Dominica (? introduced), Barber; St. Vincent (sub nom. *F. gigantea* var. *Willemetiana*) Kew Bull.

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* The writer is not aware whether this is original or based on Schott's (or Perrine's) reports.

1892, p. 101; Bequia (Grenadines), Smith brothers in Hb. Kew.!; Grenada, Sir Hely Hutchinson in Hb. Kew.!; Barbados, J. D. Bovell, Hb. Kew.! Cult. in Hort. Kew. 1793, ex Hb. Goodenough. in Hb. Kew., also Mus. Brit.!

7. F. gigantea, Ventenat in Bull. Soc. Philomat. 1793, and Usteri Ann. xix. pp. 54–60; Bot. Mag. 2250 (1821) (*Furcroea*); Belg. Horticole 1860, p. 219, pl. 34. [x]

Hab. Costa Rica, vern. "cabuya" Oviedo (1529)?; Do. 5 vern. "cabuya olancho," Biolley in Boletin Soc. Nac. de Agricultura [Costa Rica] no. 5, 10 Aug., 1906, pp. 74–81 with fig.; Chiriqui volcano in Panama, Seemann, Voy. "Herald" p. 216, no. 973 (sub nom. *F. tuberosa*, Ait.); also cult. in prov. Veraguas (ident. not certain); "Panama v. 842 vulgo cabuya," Seemann in Hb. Mus. Brit.!; Isle of Cacagual, Darien, Seemann, Voy. "Herald" p. 216, no. 972; La Paila [upper Cauca] Holton, Fl. Neogranadina-Caucana no. 149 in Hb. Kew.!; Curaçao, Boerhaave in Ind. Alt. Pl. Hort. Lugd. Bat. (1720) ii. 129; Isles de Salut, French Guiana (1854), sub nom. "*Agave vivipara*" Sagot no. 557 in Hb. Kew.!; Trinidad, Fendler no. 852 in Hb. Kew. (ident. doubtful)!; Martinique, Hahn no. 1122, in Hb. Kew. & Hb. Mus. Brit.! also Duss, "Fl. Phan. des Antilles Franç." in Ann. de l'Inst. Col. de Marseille iii. (1896) 558–9, no. 3602 (not seen); Guadeloupe in hedges, etc., Duss (l. c. no. 2125, not seen).

Introduced, Isle de France (sub nom. "*Agave foetida* = Aloes vert"), Aublet, Fl. de Guiane, etc. i. 305; loc. incert. Hb. Willdenow. in Mus. Berlin sub nom. "*Agave vivipara*"!; Mascarene Islands, with printed ticket "Fl. Maur. ii. no. 373" (and named "*Aloe viridis,*" in MS.) in Hb. Kew.!; Mauritius, ex Hb. Bojer. in Hb. Kew.("*Agave vivipara*")! Ayres no. 26 (type of Baker Fl. Mauritius, p. 367), also Ayres (bis) "hills above Port Louis, very common throughout the islands," both in Hb. Kew.!; Central Madagascar, Baron no. 2302, 1993 (?), 2638 (?) in Hb. Kew.!; Seychelles, E. P. Wright in Hb. Mus. Brit. (flowers only, ident. & loc. doubt.)!; Sibpur (Calcutta Bot. Gard.) 1904–5!!; also (flowers only, ident. & loc. doubt.), "Jamaica," Morris, also Hart no. 1534 (probably in either case from a garden).

8. F. elegans, Todaro,* Hort. Pan. i. p. 13, t. 4 (1875) (*Fourcroya*).

Hab. unknown; cf. Tobago, Eggers no. 5706 (flowers only, ident. doubtful) in Herb. Kew.! The sketch of a Tobago plant given to De Laet by a friend which De Laet erroneously identified with the Nequametl of Hernandez (see above, p. 37), resembles Todaro's figure of *F. elegans* more than any other species; Jacquin, who evidently had not seen the woodcut in the "Thesaurus," thought presumably that the margin prickles were exaggerated in the sketch, but it seems unlikely that the true *F. cubensis* should be found in Tobago. If the sketch is at all faithful, then the only species that answers it is this of Todaro; but see also *F. stricta* (under imperfectly known species).

9. F. Selloa, K. Koch in Wochenscrift 3 (19 Jan. 1860), p. 22; Bot. Mag. 6148 (1875) (*Fourcroya*). [x]

Hab. unknown. The original type had not flowered, and there is nothing to show whence it came to Sans-souci (Potsdam): K. Koch conjectured that it was introduced by von Warszewicz from Guatemala, and the original home is given by Jacobi as "volcano of Quassaltinanga in Guatemala," but this seems to require verification. The only herbarium specimens at Kew are from cultivation in England.

10 F. macrophylla, Hook. fil. in Ic. Plant. t. 2501 (1897.) [x]

Hab. Riofrio, cult., no. 1951 comm. Kalbreyer (in 1881), with name "*Agave vivipara* var. ?" and the remark "fiber of the leaf very much used for making sacks, bags, slippers, packsaddles, etc."; Bahamas, Eggers, nos. 4194, 4399, 4400a (1888) in Hb. Kew.!; old quarry near Nassau, New Providence (Bahamas) Curtiss no. 127 in Hb. Kew.!; received from Hart, Trinidad, 1889; in Hb. Kew. (loc. doubt.)!

This well marked form appears to be so far unknown except in cultivation or as an escape; but it is by no means restricted, as it has been said to be, to the Bahamas, and its home, if it occurs in a wild state at all, is most likely on the

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* Represented at Kew by plants from Palermo, which are still too young for determination or description.

mainland towards the Isthmus or in the southeast parts of Central America. The only Riofrio shown in European maps of South America is in North Chile.

Key to the Species of Group B "Giganteae."

Margin prickles of mature leaf less than two lines long, little curved, spreading. *cubensis.*

Margin prickles of mature leaf more than two lines long, strongly uncinate, ascending.

Leaf at greatest width fairly broad in proportion to its length, (about 1 : 8 or more).

Leaf oblong-lanceolate, germen longer than the perianth lobes; juice of leaves not fetid. *tuberosa.*

Leaf obovate-lanceolate, germen equalling or shorter than the perianth lobes; juice of leaf fetid. *gigantea.*

Leaf at greatest width narrow in proportion to its length, (about 1 : 10 or less).

Margin prickles approximate (0–1 in. apart).

Neck of leaf gradually narrowed to about 3 in. at the narrowest part. *elegans.*

Neck of leaf constricted to about 2 in. at the narrowest part. *Selloa.*

Margin prickles distant (1–4 in. apart). *macrophylla.*

Species Non Satis Notae.

F. AGAVEPHYLLA, Brotero ex Schultes Syst. Veg. vii. (i.) 731 (1829).

The paper in which this was propounded is shown in the records of the Linnaean Society as received from Felix D'Avellar Brotero on the 30th of January, and read the 8th March, 1823; it seems to have been made over to the referee, but not printed, and no evidence of its contents is apparently procurable beyond the notice in Schultes, to whom presumably a copy of the author's MS. was accessible. The plant is said to have been found in Maranhao, Pernambuco, and other parts of the Brazils, and can hardly have been Jacquin's Cuban "*Agave*" (*F. cubensis*, Vent.); indeed Schultes himself (pt. ii. p. 1717) suggested ultimately that it might be rather "*Agave vivipara*" of Arruda da Camara, above cited. It is doubtful how far Arruda's "Caroata assu" represents

any actual *Furcraea*, but if he was acquainted with a Pernambuco species, known to the Indians as a "Caroata", that may very well have been Brotero's plant, and possibly the same as Piso's original Caraguata-guaçu (not Marcgraf's), and also De Laet's Tobago drawing, which, taken with Jacquin's citation of "Nequametl, Marcgraf," is no doubt responsible for the identification of Brotero's plant with Jacquin's. The proper citation,—if De Laet's sketch was to be identified with *Agave cubensis*, Jacquin,—would have been "Nequametl, De Laet, *non* Ximenes vel Hernandez in Recchi," but in all probability De Laet's so-called Nequametl, if the sketch be worth anything, was quite different from the Cuban species (see also *F. elegans* above).

F. AITONI, Jacobi in Abhandl. Schles. Gesellsch. 1869, p. 174.

The description of the leaf, as Dr. Trelease has observed, recalls the *F. gigantea* of Bot. Mag. 2250, but Jacobi clearly referred his *Aitoni* to the neighbourhood of *undulata* (*i. e.* the "Minores" of this paper). No trace exists at Kew, and unless there are authentic specimens on the continent of Europe, *F. Aitoni* is never likely to be identified.

F. ASPERA, M. J. Roemer Syn. iv. p. 293 (1847) = *Agave aspera*, Jacq. in Enum. Vindob. App. 307.*

Jacquin was careful to distinguish this from his "*hexapetala*" (Enum. Syst. Plant. 1760, p. 18), which is *Furcraea cubensis*, Vent., and observed that in habit it was like a small edition of *Agave foetida*, L., *i. e. F. gigantea*, Vent.; the flowers were altogether those of "*hexapetala*": by this however he did not mean to contrast them with those of *F. gigantea*, but with the type of *Agave* as we now regard it in contradistinc-

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* In the same year that the second edition of the "Enum. syst. stirpium quae in Ins. Carib. etc." issued, Jacquin published the "Enum. stirp. plerarumque . . . in agro Vindobon. etc." with which there were printed and continuously paged, under a common title page, "Observationum Centuria" (on certain plants of Mid-Europe), "Appendix de paucis exoticis," and at the end copperplate engravings to illustrate the "Observationum Centuria." *Agave aspera* is dealt with in the "Appendix."

tion to *Furcraea*. See further *F. Commelyni* and *F. spinosa*, below. Whatever "*aspera*" may have been it certainly was not *F. cubensis*, Vent.

F. ATROVIRIDIS, Jacobi & Goeppert in Otto, Hamb. Zeit. xxii. (1866), p. 328.

Baker (Amaryll. p. 199) reduced this to *F. gigantea*, Vent., but Jacobi gives reasons for distinguishing "*atroviridis.*"

There is a plant at Kew which may be distinct from either *gigantea* or *tuberosa*, and answers fairly to Jacobi's marks for *atroviridis*, so that pending further information the name had better be kept up provisionally.

The "*F. viridis*" of Index Kewensis ii. 984 is based on the citation of a synonym in the Biologia Centr. Amer., and relates to *F. atroviridis*, Jacobi & Goeppert.

F. BARILLETTI, Jacobi in Abhandl. Schles. Gesellsch. 1869, p. 166.

Apparently a garden variation of *gigantea* or *tuberosa*, and unless authentic specimens can be produced for examination the name should be abandoned.

F. COMMELYNI, Kunth Enum. v. 842.

This is the *Agave Commelini* of Salm-Dyck in "Annotationes Botanicae" to the "Hortus Dyckensis," (1834), p. 301, which was expressly referred by that author to t. 19, vol. iii. of the Hortus Amstelodamensis (*i. e. F. tuberosa* Ait. in the writer's view); but Jacobi, who had seen the original specimen at Schloss Dyck, pointed out certain differences, and the probability seems to be that it was really *gigantea*, unless indeed it was the "*flavoviridis*" of Hooker in Bot. Mag. 5163 (1860). The succulent collection of the Dyck Garden was dispersed after the demise of its founder; a few descendants are preserved of certain species, but the writer could not trace "*A. Commelini*"* among them.

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* In the "Annotationes" it was proposed to restrict *Furcraea* to the single species *longaeva*, Zuccarini.

The next question is whether the plant of Salm-Dyck was that described in the "Amaryllideae" p. 200 (1888) by Baker. The descriptions do not altogether tally, and there is no specimen of the leaf in the Kew Herbarium; so far as the text goes, the plant of the "Amaryllideae" might be true *gigantea*, Vent., but perhaps we should find it rather in the "*F. cubensis* var. *inermis*" of Bot. Mag. 6543 (1881). There are flowers in the Herbarium on which Mr. Baker has written, "*F. Commelynii* Hort. Kew. Sept. 1874 is *F. gigantea* small variety," and these correspond to flowers belonging to a spray from a *Furcraea* which poled in the garden during 1859–60 while they differ somewhat from all those examples which the writer has been able to refer to *gigantea*, *tuberosa* or *cubensis*. The plant which flowered in 1859 was attributed in the first instance to *F. gigantea*, but a later hand has substituted "*F. flavoviridis*," from misapprehension possibly of a passage under Bot. Mag. 5163, where Sir W. Hooker remarks that "*flavoviridis*" might have been referred, but for the absence of a "tuberous" stem, to *F. tuberosa* and adds "We have plants that have not yet flowered which . . . better correspond with *F. tuberosa* and I am bound to consider a new species, which Mr. Repper sent, twelve or fourteen years ago, . . . from Real del Monte. It may be considered a *F. gigantea* in miniature; the flowers however being quite as large and of the same structure as *F. gigantea* already given in Bot. Mag. tab. 2250."

The concluding sentence manifestly refers to *F. flavoviridis*, though the flowers in the figure are about twice the size of those of *F. gigantea*, corresponding to examples, probably abnormal, that exist in the Herbarium; but one way or another it is evident that the *Furcraea* of Bot. Mag. 5163 has been more or less confused with the plant that flowered in 1859, which the writer thinks must have been the same as Bot. Mag. 6543 ("*F. cubensis* var. *inermis*").

It seems further possible that "*inermis*" is the plant figured by Redouté for the Plantes Grasses and Tussac's Flore des Antilles as *F. gigantea*. Although superficially resembling *gigantea*, the plant of Bot. Mag. 6543 will in all likelihood

prove perfectly distinct, and if finally established must receive a fresh name as it probably is not the "*Commelini*" of Salm-Dyck, and is certainly distinct from no. 19 of the Hort. Amstelodamensis. It is very difficult to say now what the types at Dyck of "*F. gigantea*" and "*F. tuberosa*" may have been, and on those depends the identity of *F. Commelyni*, Kunth, for Jacobi's "*tuberosa*" is the Dyck plant, and his views on "*gigantea*" were based largely on Salm Dyck's; of "*gigantea*" he had never seen a flowering specimen, and his description, in so far as it is original, indicates "*cubensis* var. *inermis*" of Baker rather than the true *gigantea*. It must be remembered that the "*cubensis*" of Salm-Dyck and Jacobi was not Ventenat's *cubensis*. The former supposed the plant of Jacquin to be the var. β of Aiton's *tuberosa*, which is "*geminispina*" of Jacobi,—the Dyck "*tuberosa*" from the description being somewhat different; what it may have been must be left for the present, but it could hardly have been genuine *tuberosa*, Ait. fil. in any case. Jacobi's *tuberosa*, so far as the leaves go, was taken from the Dyck "*tuberosa*" but the inflorescence was described from a different example, which Jacobi afterwards propounded (Abhandl. Schles. Gesellsch. 1869, pp. 168, 169) as a distinct species named "*F. lipsiensis.*" In the synonymy under *F. Commelyni*, no. 19 of the Hort. Amstelod. is given by Jacobi as equivalent to *A. Commelini* of Salm-Dyck, but in the text he argues that Salm-Dyck was mistaken on this head, and that Commelyn's no. 19 should rather be identified with *F. tuberosa*, Ait. Under *F. cubensis* he cites *F. tuberosa*, Ait. var. β though he had already quoted "Willdenow Sp. Pl. p. 194, *F. tuberosa* β spinis duplicibus" for his own "*geminispina*"; whereas Willdenow's "*Agave tuberosa*" is avowedly a mere extract from Aiton, the sole species known to Willdenow himself having been the plant named in his Herbarium "*Agave vivipara*" which, so far as can be judged, was *F. gigantea*, Ventenat. The fact is that *F. cubensis* was, and evidently is still, rare in collections, and but scantily represented by dried specimens, if indeed in the older herbaria there were any specimens at all.

The true *gigantea* also probably is seldom reared in Europe,

the cause being doubtless that it wants a moister atmosphere than is usually accorded to the Agaveae, as known xerophytes, in our houses; and the same applies, though not quite so fully, to the real *tuberosa* of the Hortus Kewensis. If "*inermis*" (Bot. Mag. 6543) was the plant collected in the mountains south of the city of Mexico by Repper, it would be accustomed to a very different climate from the coasts of the Isthmus and of South America, but it seems identical with a plant of Fendler's (no. 1548 in Hb. Kew.) from Tovar in the interior of Venezuela.

It follows from the above that "*F. Commelyni,*" both of Kunth and of Baker, must be dropped altogether, and when the so-called "var. *inermis* of *cubensis*" can be properly described a distinctive name must be found for it. The "*cubensis*" contemplated in Bot. Mag. 6543 was not Jacquin's plant at all, but one of Haworth's creations (for which see the Synonymy below). In the Amaryllideae Baker cites the type from Goodenough's Herbarium of F. *tuberosa*, Ait. fil. for his "*gigantea*" (p. 199), and distinguishes "*gigantea*" by the trunk reaching 3-4 feet in length, so that his "*gigantea*" must be taken as in part at least equal to Aiton's *tuberosa*, though in part the true no. 18 of Commelyn. His "*cubensis*" similarly is in part, by the description, Jacquin's *Agave cubensis*, but the leaf is manifestly rather that of *F. Selloa*, specimens of which are often marked in gardens "*F. cubensis.*" Mr. Baker says distinctly that he had no reliable specimens of *tuberosa*, and took his description from Jacobi and Hasskarl (Retzia, ii. p. 16, d. 1856); but Hasskarl's description was from a plant received from Sydney which flowered at Buitenzorg, and was evidently *F. gigantea*, Vent. The "*tuberosa*" of Salm-Dyck and (in part) of Jacobi will be considered further under *F. spinosa*.

The writer would have liked to give complete descriptions of each of the species in this group, but hesitates to attempt this without full grown living specimens before him. For the following provisional description of the Antigua plant he is largely indebted to Mr. Barber's notes and photographs already mentioned. By kind permission of the Director of the Royal Gardens certain of these photographs, and others

from the Herbarium, are reproduced to illustrate this memorandum.

F. tuberosa, Ait. fil. in Hort. Kew. ed. 2, ii. 303.—*Trunk* in young plants inconspicuous, in old examples 3-6 ft. long, often decumbent, sometimes partly twisted, 5-10 in. thick, succulent within. *Leaves* about 40 in a somewhat loose tuft, almost upright, or ascending, but when old reflexed, splitting, smooth on both sides, bright green, oblong-lanceolate, typically, at 2 in. from the base, 6 in. broad, narrowed to 5 in. at 8 in. above it; at their greatest width, that is about the middle of the leaf (3½ ft. from the base), about 10½ in.; about 6½ feet long but attaining 8 feet and upwards; margins to 10 in. from the base flat, free from prickles, or with minute retrorse teeth, which increase upwards, at the middle more or less irregularly set at intervals of 0–1 in. with reddish-brown prickles up to ⅜ in. high, arising from a thickened projection of the leaf-border, uncinate; bases of the prickles sometimes geminate by suppression of the margin-interval, which is normally deeply indented but in old leaves nearly straight; margin more or less involute above the middle of the leaf, ultimately forming a groove one to three inches deep, devoid of prickles in the uppermost fourteen to eighteen inches; tip convolute into a blunt scarcely pungent conical acumen.* *Scape* 15–25 feet high, the often dense oblong thyrsoidal panicle reaching ten feet or more; perianth-lobes about 1⅙ inch × 7 lines, greenish-white without, white bordered, shorter than the germen which attains 1½ in.; capsule oblong-ovate; bulbils usually numerous, broadest at the base, sharp pointed.

F. CUBENSIS, Haw. var. INERMIS, Baker in Bot. Mag. 6543 (1881) (*Fourcroya*). [x]

See the preceding. The *F. cubensis* of Haworth (Syn. p. 73) is not the same as *F. cubensis* of Ventenat; it is true

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* In young leaves the tip of the leaf is often hardened into a false spine and disarticulates; in old leaves the acumen is very often shod, as it were, with a blunt horny callus. In no *Furcraea*, so far as the writer's knowledge goes, is there ever a true fibrous terminal spine such as is manifest in many other Agaveae.

that he quotes "Willd. Sp. Pl. 2. 193" and that the plant indicated by this reference is the *Agave cubensis* of Jacquin, but he further cites *F. tuberosa* β of the second edition of the Hortus Kewensis, which is a different species altogether, with the result that in England "*F. cubensis*" has been usually applied to a plant which approaches *tuberosa*, certainly, but is probably in fact *F. Selloa*, K. Koch, and in any case is not the Cuban species of Jacquin. There is no proof that Mr. Baker's plant is derived from any of the established species; it may be the *Agave aspera* of Jacquin (Enum. Vindob. App. 307), and the "*F. gigantea*" of the figure (but not the letterpress which is taken from Ventenat) in the Plantes Grasses 126 bis, repeated in the Flore des Antilles of Tussac (ii. 25, 26) for the San Domingo plant which is actually *F. tuberosa*, Ait.

F. DEMOULINIANA,* Jacobi in Hamb. Zeit. xxiii. (1867), p. 310.

Not now apparently in cultivation; supposed to have been brought from Mexico by Galeotti; the description reads like that of a monstrosity, but the large bulbils recall Triana's specimen from the Colombian Andes previously mentioned.

F. DEPAUPERATA, Jacobi in Hamb. Zeit. xxii. (1866), p. 411.

Based on a single specimen. Possibly identical with Baker's *albispina*, but it is particularly unsafe in this genus to identify plants from descriptions solely without living specimens or at least reliable herbarium material.

F. FLAVOVIRIDIS, Hook. in Bot. Mag. 5163 (Feb. 1860) (*Fourcroya*).

The writer cannot separate this from *F. Selloa* of the Kew Garden and Herbarium except by the very large flowers in one specimen which agree with the illustration but are probably abnormal, and by the generally small proportions of the flowering plant; it is hardly safe, however, to rely on the pro-

* There are young plants received at Kew under this name but they are altogether doubtful.

portions of a *Furcraea* when it has poled in a garden, unless these prove constant over several generations; even then, as Mr. Baker has well pointed out, it would not be advisable to lay stress on the dwarf condition unless other characters accompany.

The original "*Selloa*" of K. Koch has only a few days precedence of "*flavoviridis,*" and was founded on a plant (that had not flowered) at Sans-souci, but the name is well established as attaching to the form recognized at Kew as *Selloa*, and on the whole the best course seems to be to treat "*flavoviridis*" for the present as a synonym of *F. Selloa*, until fresh examination can be made of flowering examples. To complete the matter, *Selloa* and "*flavoviridis*" should also be compared with "*Lindeni.*" It is not impossible that the Dyck "*tuberosa*" may have been "*flavoviridis*"; the native country is not really known in either case, for the mention under Bot. Mag. 5163 of Repper's Mexican collections does not relate to "*flavoviridis*" but to a different plant which may have been the same as "*cubensis* var. *inermis*" of Baker (see *F. Commelyni*).

"F. GIGANTEA", Wettstein Veg. Bild. Sud. Brazil (1906) pl. iv. (non Ventenat).

This name is attached to a *Furcraea* which figures in an illustration from a water color sketch by F. von Kerner of the "Edge of the Savanna in the dry season near Itapetininga," a place in São Paulo, in southeast Brazil, about 25° S. Lat.

It can hardly be *F. gigantea*, Vent., and may be an undescribed species.

F. LINDENI, Ed. André in Ill. Hort. xxi. (1874) pl. 186, p. 167. (*Fourcroya*). [x]

M. André cites Jacobi "in Linden Catalogue," and notes that the plant was brought to Linden in 1868 from near Cali in the Cauca valley of Colombia (see also "Tour de Monde" xxxiv. 1875–6, p. 133), where it existed in small quantity. It may be doubted whether this handsome plant has not, like *Agave americana* var. *variegata*, a cultivated origin, and so

far as the leaves go it is very near *F. Selloa*, but until the inflorescence can be studied, it is better to retain it as a species. The earliest mention of the plant appears to be in the Gardeners' Chronicle, 1869, p. 587, as having been shown by Linden at the Russian International Horticultural Exhibition of that year. The writer has unfortunately not succeeded in tracing Jacobi's description. Lehmann no. 8676, on cliffs at 1000–1800 meters round Popayan, may be this. The leaves (probably from the inner part of the tuft), are not variegated;—they resemble those of *Lindeni* or *Selloa* but have not the "emery paper" under-surface; the flowers are too small for *F. Selloa* of the Kew Herbarium.

F. PUBESCENS, Todaro "Sopra una nuova sp. di Fourcroya" (1879), pp. 9–14.

From the figure this can hardly be the "*pubescens*" of Baker in Bot. Mag. 7250 (1892) which is the same as F. *undulata*, Jacobi, assuming at least that the *undulata* of Bot. Mag. 6160 (1875) represents Jacobi's species, which seems to the writer practically certain. The degree of pubescence evidently varies in these dwarf Furcraeas within somewhat wide limits; it is remarkable that they share this character, which is altogether absent in the "Giganteae," with the arborescent "Serrulatae."

From Todaro's description, and the representation of a stem-leaf on pl. ii. (fig. 5, omitted in the explanation), *F. pubescens* would appear to differ from all known Furcraeas by the remarkable arrangement of the leaves which extend to the scape, and, though modified in shape, only disappear at the base of the first branch of the panicle.

F. SPINOSA, Targioni-Tozzetti in Obs. Bot. dec. i. & ii. (1808) pp. 33–36, tab. iv. fig. 1–16, 27, 28, & 32 = Rodati, Ind. Hort. Bot. Bonon. (acc. Obs. de Agaves spec.) p. 27, t. 1.

On the whole this would seem to have been *F. tuberosa*, and if this were demonstrable "*F. spinosa*," as the name, would have priority; but the figures indicate a shorter, rather narrow leaf, and may represent a plant collected at Sta.

Martha in Colombia by Purdie of which specimens are extant in the Kew Herbarium. *F. spinosa* was grown by the Botanical Society of Florence under the wrong name of "*Agave virginica*"; being thence transplanted in 1783, several plants in different gardens flowered in 1796, 1799, and 1807, and have been described by Targioni-Tozzetti who has identified them with the "*Agave*" of Rodati's memoir above quoted which is undated, but was published, from internal evidence, after 1797. This might be the "*tuberosa*" of the Dyck garden, or even possibly, though less probably, the *stricta* of Jacobi; there remains "*flavoviridis*," but the probabilities are all in favor of the Florence plant having been a form of *tuberosa*, Ait. fil., in which case the Magdalena plant of Purdie represents an undescribed species, unless as above said, it should turn out after all to be the *elegans* of Todaro. Grisebach in the "Catalogus Pl. Cub." duly recognized Wright's no. 3250 as the true *cubensis*, but in the Flora of the British West Indies (1864) he admitted only two West Indian species viz."*cubensis*" and "*gigantea*"; to the former he attributed "leaves linear lanceolate, coarsely spinose-*dentate*," which is plainly meant for *tuberosa*, and yet cited "Jacquin Amer Pict. t. 281 f. 25" which is, of course, the "*ciliato*-spinose" *Agave cubensis*. This he gives as "naturalized in Jamaica" citing Purdie, whose plant was collected, as we have just seen, on the north coast of South America; if any doubt existed as to the supposed Jamaican habitat it would be dissipated by the sets at Kew, where one sheet of Purdie's Santa Martha gathering is marked "*F. cubensis*" in the handwriting of Grisebach. His "*gigantea*," so far as the Antilles are concerned, was no doubt *tuberosa*, Ait. fil., for he cites Tussac and, as the only example he had personally seen, gives a specimen collected by Wullschlaegel in Antigua. It seems possible that Purdie's plant is the *elegans* of Todaro; and in that case we should probably reduce *tuberosa*, Ait. fil., to *spinosa*, Targioni-Tozzetti, on the one hand, and *elegans* of Todaro to *stricta* Jacobi on the other, but see *stricta*. In any case until the Furcraeas of South America have been further studied,

nothing can be gained by too summary revision of the nomenclature.

F. STRICTA, Jacobi in Abhandl. Schles. Gesellsch. 1869, p. 171.

From the description this might be the *elegans* of Todaro, or even *macrophylla*, Hook. fil., but the only specimens that come near it are those of Purdie from the Magdalena littoral discussed under the preceding. Jacobi's is too small in its proportions for normal *macrophylla*, and the geographical range of this moreover is uncertain. It seems hopeless to identify Jacobi's plant at the present day, and the writer therefore has included *elegans* in the list of known species, as it is at least supported by an elaborate description and figure. In the Kew Herbarium there is a noteworthy specimen from the Rottlerian Herbarium, taken by Klein on Oct. 25th, 1811, from the Mission Garden at Tranquebar in S. India, which has quite the leaf of *elegans* or *stricta* as described by their authors; the flowers accompanying are undoubtedly those of a *Furcraea*, but the leaf, which seems to have a terminal spine, is hardly distinguishable from that of *Agave Cantala*, Roxb. It seems not impossible that the *Fourcroea Cantala* of Haworth was suggested by this or a similar example, taken with Linnaeus' citation under his "*vivipara*" of Rumpf's fig. 109 in vol. v. of the Herb. Amb., which is *A. Cantala*, along with Commelyn's "*polygona*," a quite different species.

F. VALLECULATA, Jacobi in Abhandl. Schles. Gesellsch. 1869, p. 175.

Sent from Kew to Jacobi as "*Selloa*," but evidently something different, possibly the S. Brazilian plant depicted by Wettstein (see "*F. gigantea*," Wettstein, non Ventenat, above). Until we know more of the South American forms it would be inexpedient to exclude the name altogether.

F. (FOURCROYA) VIVIPARA, p. 587, Gard. Chron. 1869.

This was probably, from the indications, *F. tuberosa*, Ait. but it does not appear by whom it was exhibited, and the

writer cannot discover how the name originated, though it is quite likely that it refers to the *Agave vivipara* of Willdenow. Linnaeus' "*A. vivipara,*" if we exclude certain erroneous synonyms, was based on Casper Commelyn's* "*Aloe polygona*" which that author himself identified with Munting's "*minor*" and regarded as quite different from Hermann's "*sobolifera*"; from the figure it was clearly an Eu-Agave of the "*Keratto*" type.

Miller's *Agave vivipara* has a different history. Up to the 6th edition (1752) of the Gardener's Dictionary he did not distinguish *Agave* from *Aloe*, and his *Aloe* no. 7 is "Aloe americana sobolifera" of Hermann. In the 7th edition *Agave* was separated, but without the use of Linnaean binomials. Under the 5th kind, the "Childing Aloe," Hermann's "*sobolifera*" is cited, but the description in the text refers manifestly to a species of *Furcraea*, and the writer thinks there can be little doubt that the plant intended was the *F. undulata* of Jacobi, or a closely allied species. The 8th edition, which is that most usually quoted, simply repeats under "*A. vivipara*" this account given in the seventh. In the 1st edition (1789) of the Hortus Kewensis, Linnaeus (Sp. Plant.) and Miller's 1st edition are cited, and it is stated that Philip Miller had the plant in cultivation [at Chelsea] in 1731. In the second edition (1811) the synonymy is expanded, and among others Willdenow, whose specimen was a *Furcraea*, is quoted, but the plant itself is not now represented in the Garden unless by examples since referred to *F. undulata*, Jacobi or *pubescens*, Baker (non Todaro). The "*A. vivipara*" now at Kew, as already stated, is a modern importation from the East Indies and is *Agave Cantala*, Roxb., as is likewise a dried specimen in the Herbarium from the Philippines.

F. Watsoniana, Hort. Sander. ex script. anon. in Gard. Chron. 1898, i. 243. [x]

This name appears first in an account of a Horticultural Exhibition at Ghent in 1898, and the illustration leaves no

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* Praeludia (1703) p. 65, fig. 15.

doubt of the plant's identity with that now in the "Succulent House" (No. 5) at Kew. Mr. Watson, Curator of the Royal Gardens, to whom the writer desires to express his acknowledgments in connection with these notes, considers that this is a variety of *F. gigantea* Vent., and there can be no question in the writer's view that this is the origin of a most elegant and interesting form, bearing much the same relation to *F. gigantea*, Ventenat that *Agave americana* β *variegata* Bot. Mag. 3654 does to the much less common green form of *A. americana*, Linn.

Synonymy.

In dealing systematically with the Agaveae it is hopeless to attempt adjustment of the post-Linnaean nomenclature without mastering the literature that went before the Species Plantarum; but the writer has endeavored in the preceding notes to clear the ground so far as necessary for the present purpose and it need not be gone over here afresh.

Local and vernacular appellations also, even when taken up in formal treatises, are noticed only under the connected scientific names, and this solely where it seemed unavoidable. Under *Furcraea* (and its various spellings) names that are never likely to be verified, and "excluded species," are distinguished by the mark (†); where a name was published under some other genus than *Furcraea* it will be found under that other genus; the arrangement of genera and, under each genus-title, of the species, is alphabetical; only the author's name is stated unless more precise detail seemed to be called for; in most cases the full reference has been given in these notes already.

Agave *angustifolia**, J. fide Hort. Par. ex Lamarck, Enc. (1784) non Haworth.	= Agave tuberosa, Mill.? f. Lamarck.

* All names that were at any time valid under the Linnaean genus *Agave* are to be traced under **Furcraea** Vent.

angustifolia, Hort. Par. ex Steudel Nom. (ed. 2) i. 36 (1840).	= AGAVE ANGUSTIFOLIA J. f. Hort. Par. ex Lamarck (preced.)
aspera, Jacquin (1762).	= FURCRAEA (Fourcroya) ASPERA, M. Roemer.
australis, Steudel Nom. (ed. 1) p. 18 (1821).	= FURCRAEA AUSTRALIS, Haworth.
campanulata, Sessé et Moc. Fl. Mexic. ant.1809 (?)	= **Furcraea tuberosa**, Ait. fil.

The date of the original publication is not ascertainable from the writings of Colmeiro & Ramirez, or any other authority at present accessible to the writer; but Sessé died between 1804 and 1809 apparently. The description is inadequate, but as the plant was collected at the town of San German in Puerto Rico it was probably *F. tuberosa*.

Commelini, Salm Dyck in Hort. Dyck. (1834).	= FURCRAEA COMMELYNI, Kunth.
cubensis, Jacquin (1763).	= **Furcraea cubensis**, Ventenat.
cubensis, Sprengel Syst. ii. 29 (1825).	= FURCRAEA CUBENSIS, Haworth.

Sprengel, who was followed by a few later authors, put back the species of *Furcraea* known to him from previous works into *Agave*, on manifestly insufficient grounds. The "*cubensis*" of Haworth is not *F. cubensis*, Ventenat because for one thing it includes *F. tuberosa*, Ait. fil. *β*, which is *F. tuberosa*, Ait. fil. of the present paper.

foetida, Linn. (1753) also Sprengel (1825).	= **Furcraea gigantea**, Ventenat.
foetida, Aublet (1775).	= FURCRAEA GIGANTEA, Ventenat.

The remarks extend, however, to *Furcraea tuberosa*, Ait. fil. by implication.

foetida Lamarck (1784).	= FURCRAEA GIGANTEA, Ventenat (ex desc.)

The remarks, however, rather point to *F. tuberosa*, Ventenat.

gigantea, D. Dietr. Syn. Pl. ii. 1192 (1840).	=	**Furcraea gigantea,** Ventenat.
hexapetala, Jacquin (1760).	=	AGAVE CUBENSIS, Jacquin (1763), *i. e.* **Furcraea cubensis,** Ventenat.
madagascariensis, Sprengel Syst. ii. 79 (1825).	=	FURCRAEA (Fourcroea) MADAGASCARIENSIS, Haworth Suppl.
mexicana, Poiret Suppl. 241 (1810).	=	**Furcraea cubensis,** Ventenat.

Towards the end of the 18th century the Jardin du Roi at Paris possessed, among other Agaveae, a plant named *Agave mexicana*, which was very likely that listed by Desfontaines under the same name in 1804 (Tableau de l'Ecole, p. 28). Desfontaines' "*mexicana*" was in all probability the species still known under that name in certain gardens of South Europe (cf. specimens and photographs in Herb. Kew. from the Ricasoli garden at Florence, also from Coimbra), but commonly (in its naturalized condition) as "*americana*", which is *A. Vera Cruz* of Philip Miller (Gard. Dict., ed. viii. 1768), and possibly *A. lurida* of Aiton in Hort. Kew., but not of Jacquin. In the Encyclopédie Méthodique (1784) i. 52, Lamarck mentioned the Paris Garden plant, citing as the only synonym "Aloe americana flore luteo" of Morison (Hist. p. 415), "Metl or Maguei of the Mexicans"; but this "Aloe" of Morison's was little better than a figment based on a misreading of Recchi's edition of Hernandez, where there are two "yellow Magueys" one of which is Tlacametl, and the other Metl Cotzli, but neither is the pulque-yielding Maguey of the Mexicans, *i. e.* the half mythical Metl par excellence of the early authors. Of his typical "*mexicana*" Lamarck printed no description, but he placed with it,—as var. β—Jacquin's *Agave cubensis*. The description which follows the "variety" is taken from Jacquin and applies to *cubensis* solely, but remarks are added which relate to the supposed

Maguey. Jacquin's Cuban plant is *Furcraea cubensis* of Ventenat, and is not known to occur anywhere near Mexico proper; J. N. Rose (Contrib. U. S. Nat. Herb. v.) and others have shown that the pulque is obtained from different species of Eu-Agave, largely from A. *atrovirens*, Karwinski, but not from *A. americana*, or "*mexicana*", and further that the pulque-producing species are perfectly distinct from those from which in practice fiber is extracted. In the Supplement of 1810, Poiret (under *Furcraea* as a section of *Agave*) redescribed "*Agave mexicana*, Lamarck," (which by later usage would be "*A. mexicana*, Hort. Par. ex Lamarck") omitting the original synonymy, but ascribing to the *type* Jacquin's *Agave cubensis*, which Lamarck himself restricted to variety *β*. Poiret at the same time added as a synonym *Agave odorata*, Persoon,—a name wrongly coined for the Cuban plant of Jacquin. If we set aside Lamarck's synonym, and fall back for his type (for which only could the name "*mexicana*" be retained in any case) on the actual Garden plant, which was very likely, though proof is impossible, equivalent to the *Agave Vera Cruz* of Miller, then "*Vera Cruz*" has at least a dozen years' priority, and was moreover supported by an adequate description and correct synonymy. If on the other hand we exclude the original "*mexicana*" of Lamarck as being simply Morison's imaginary species, we are left with *A. mexicana*, Poiret (1810) (which is *A. mexicana*, Lamarck in part only), and that is merely a belated synonym of *Furcraea cubensis*, Vent. (1793), which is *Agave cubensis*, Jacquin intact, but duly transferred to the genus *Furcraea*. T. Moore, in Gard. Chron. 1879 (pp. 583 & 614), revived "*mexicana*" for an Eu-Agave, which, though not certainly identified, may have been a good species; but in view of the ambiguous origin and confused treatment of the name, its final disappearance from among the Agaveae is greatly to be recommended.

odorata, Persoon Syn. i. 380 (1805). = **Furcraea cubensis**, Ventenat.

spinosa, Steudel Nom. (ed. 2) p. 37 (1840). = FURCRAEA SPINOSA, O. Targioni-Tozzetti (1808).

subinermis, M. Roemer Syn. Ens. 289 (1847).	= AGAVE VIVIPARA, Arruda (infrâ).
tuberosa, Phil. Miller Gard. Dict. ed. viii. (1768) also Sprengel Syst. ii. 79 (1825).	= **Furcraea tuberosa,** Ait. fil. (1818).
tuberosa, Lamarck Enc. (1784).	= AGAVE TUBEROSA, Miller, (= preced.) f. Lamarck.
tuberosa, Aiton in Hort. Kew. (1 ed.) (1789).	= AGAVE TUBEROSA, Miller, *i.e.* **Furcraea tuberosa,** Ait. fil.
tuberosa [var.] β, Aiton in Hort. Kew. (1 ed.) (1789).	= FURCRAEA (Fourcroya) GEMINISPINA, Jacobi, *i. e.* **Furcraea tuberosa,** Ait. fil.
vivipara, Linn. Sp. Pl. (ed. 2) i. 461 (1762).	= FURCRAEA sp. (ex desc.)

The synonymy however includes Rumpf, Herb. Amb. v. t. 94 which is *Agave Cantala*, Roxb., and "Aloe americana polygona" of C. Commelin (Praeludia, p. 65, fig. 15) which was probably an Eu-Agave of the type of *A. antillarum*, Descourtilz: in the first edition of the Species Plantarum (1753), at i. 323, Commelin's '*polygona*' is the only actual synonym; P. Hermann's "Aloe americana sobolifera" (Hort. Lugd. 1687, pp. 16, 17) is cited, but in an inferior and doubtful position, possibly because Commelin had expressly declared that it was not the same as his "*polygona.*" It has been a question whence Linnaeus got his description of the stamens for his "*vivipara,*" which is that of *Furcraea;* there is nothing in the text of the Praeludia to suggest it, but the illustration might be squared by a student who had never seen the living plants with Hughes' account of the Barbados Silk-grass (see A. *vivipara*, Maycock below), published in 1750.

Great confusion has been caused by the supposition, not yet quite extinct, that the production of bulbils in the Agaveae is a definite specific character. That Linné's immedi-

ate followers looked on his "*Agave vivipara*" as a *Furcraea* is proved by Willdenow's Herbarium.

vivipara, Phil. Miller Gard. Dict. ed. viii. (1768). = FURCRAEA (Fourcroya) UNDULATA, Jacobi?

vivipara, Lamarck Enc. Meth. i. 53 (1784). = AGAVE VIVIPARA Linn. Sp. Pl. (ed. 2).

The remarks however take in *F. tuberosa*, Ait. fil.: "*A. vivipara*" of the Illustrations 235, fig. 1 (1793) is simply copied from Hermann's figure of his "Aloe americana sobolifera" and goes back therefore to the first edition of the Sp. Plantarum.

vivipara, Willdenow Sp. Pl. ii. 193 (1799). = **Furcraea sp.** (GIGANTEA, Ventenat?)

The specimen does not enable the writer to say more as to the species.

vivipara Sessé & Moc. in Fl. Mexic. ed. Ramirez, p. 87. = **Furcraea cubensis,** Vent.

The plant was collected (by Mociño?) between Havana and Guanabacoa, and the description answers to *F. cubensis*. It seems doubtful if the Island plants included in the Flora Mexicana were jointly collected; the notes on "*vivipara*" indicate but one observer.

vivipara, Arruda da Camara (1810). = FURCRAEA sp. (ex descr.)

The native South American name given in Arruda's tract (Caroata assu) possibly belonged to a Bromeliad; the Portuguese "Piteira" is believed to be usually applied to an Eu-Agave. It is doubtful how far Arruda was dealing with an actual Pernambuco plant, and not simply fitting in accounts by prior authors. It is quite possible, as Schultes has suggested, that Brotero's *Fourcroya agavephylla* may have been Arruda's "*Agave vivipara,*" but Brotero seems to have had material or reports from other parts of the Brazils before him also.

vivipara, Maycock in Fl. Barbadensis, p. 134 (1830). = **Furcraea tuberosa,** Ait. fil.

Maycock gives, in all, three different Agaveae as found in Barbados, viz. (1) "*A. americana a.*" (2) "*A. americana β.*" (3) "*A. vivipara.*" Of these no. 2 is doubtless the *A. americana* var. *β variegata* of Bot. Mag. 3654, and in Barbados, as elsewhere, a garden plant of which the origin is so far undiscovered. By his no. 1 Maycock understood one or more of the "*Keratto*" group, which is characteristic of the Western Antilles, but extends, though possibly not as an original inhabitant, to the lesser islands, and to parts of the mainland, *e. g.* the coasts of Guiana and Venezuela; he was naturally surprised to find no. 2 authoritatively named in Europe "*A. americana,*" perceiving rightly that it is a very different plant from the West Indies type which he was accustomed to refer (erroneously) to the "*americana*" of Linnaeus. For no. 3 he cites Hughes [History of Barbados] p. 224, where a good description of the local Silk-grass (cf. "Silk-Dagger" etc. in Barber) or *Aloe Barbadiensis* (cf. Hort. Eltham. tab. xix. fig. 21 and text 1, 23) leaves no room for doubt regarding the identity of Maycock's "*A. vivipara*" with *Furcraea tuberosa*, Ait. fil.: Maycock observes that the Keratto was usually planted, whereas "*A. vivipara*" occurred more in natural situations: and he adds that the Jamaica Silk-grass must be something altogether different. What that was or is, need not here be discussed, but it certainly was not any species of *Furcraea*.

Beschorneria *multiflora*, Hort. ex K. Koch in Wochenschr. vi. p. 234 (1863).	=	**Furcraea Bedinghausi,** K. Koch.
Fourcraea *gigantea*, Reichb. Fl. Exot. iii. no. 202 (1835).	=	**Furcraea gigantea,** Ventenat.

The illustration is copied from Bot. Mag. 2250.

Fourcroea *Cantala*,† Haworth Suppl. (1819).	=	**Agave Cantala,** Roxburgh?
madagascariensis,† Haworth Suppl. (1819).	=	**Furcraea gigantea,** Ventenat?

Haworth compares with this his "*F. Cantala*" which is usually regarded as the same as *Agave Cantala*, Roxburgh; but both were very young pot-plants in the Chelsea garden, and are altogether dubious.

FOURCROYA *agavephylla*, Brotero ex Schultes Syst. vii. 731 (1829).	= FURCRAEA CUBENSIS, Haworth (q. v.)
agavephylla, Brotero ex Schultes Syst. vii. 1717 (1830).	= AGAVE VIVIPARA, Arruda (supra), pro parte = **Furcraea elegans,** Todaro?
Aitoni,† Jacobi (1869).	= **Furcraea** (Fourcroya) **undulata**, Jacobi?
altissima, Todaro ex Franceschi in Bailey Cycl. Amer. Hort. ii. 620 (1900).	= **Furcraea macrophylla,** Hook. fil. (1898)?

Specimens from the Palermo Garden are at Kew, but too young for determination; the leaf resembles that of young plants of *F. macrophylla*. The name occurs, but without any description, at p. 11 in Todaro's paper on *F. pubescens* (1879): it was proposed later by Sir Daniel Morris for *Furcraea macrophylla*, Hook. fil. but was not adopted, possibly in view of its prior mention for the unpublished species. The description in Bailey's Cyclopedia (article *Furcraea* by Franceschi, Oliver and Wilh. Miller) furnished by Franceschi, is very brief, but suggests *macrophylla*.

aspera, M. Roemer (1847).	= FURCRAEA (Fourcroya) CUBENSIS var. INERMIS, Baker in Bot. Mag. 6543 (1881)?
Barilletti,† Jacobi (1869).	= **Furcraea gigantea,** Ventenat?
Commelyni,† Kunth (1850).	= **Furcraea gigantea,** Ventenat?
cubensis, Martius Fl. Brasil. iii. i. p. 192 (1855).	= FURCRAEA CUBENSIS, Haworth, non Ventenat.

The synonyms, more especially the vernacular and local

names, however, cover the "Keratto" Agaves, *F. tuberosa*, Ait. fil., and "*Agave vivipara*" of Arruda da Camara.

cubensis, Grisebach in Fl. Br. W. Indies 1864. = **Furcraea tuberosa,** Ait. fil. (ex loc. Antigua).

The Jamaican habitat is a mistake for the north coast of South America.

cubensis, Grisebach in Cat. Pl. Cub. (1866). = **Furcraea cubensis,** Ventenat.

Deledevanti,† C. Rivière in Rev. des Cult. Colon. xi. pp. 68–69 (1902). = **Furcraea tuberosa**, Ait. fil.?

Reported from Algeria; no description given, but it is probably the "Hayti Hemp" of certain markets, and may be the plant, yielding fiber of the same class as "Sisal" and "Pite d'Haiti," which forms the subject of an article by M. Fasio in Journ. d'Agricult. Tropicale no. 41 of 1904, p. 342. "Pite d'Haiti" has been commonly referred to *Furcraea gigantea*, Ventenat, but the original Haiti plant is more likely to have been *Furcraea tuberosa*, Ait. fil.

depauperata,† Jacobi (1866). = FURCRAEA ALBISPINA, Baker (1893)?

flaccida,* Hort. Panorm. ex Hort. Kew. = **Furcraea Bedinghausi,** K. Koch?

flavoviridis, Hook. (Feb. 1860). = **Furcraea** (Fourcroya) **Selloa**, K. Koch (Jan. 1860)?

geminispina,† Jacobi (1866). = **Furcraea tuberosa,** Ait. fil. (1811).

Ghiesbrechtii,† Hort. ex Jacobi (1867). = FURCRAEA (Fourcroya) DEMOULINIANA, Jacobi (1867) fide Jacobi.

Todaro however (Hort. Panorm. i. 13) gives *F. Ghriesbrechtii* (sic.) of Verschaffelt's 1867–68 Catalogues as being *F. elegans*, Todaro, which can hardly be the same as *F. Demouliniana*, Jacobi.

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* Two different forms seem to have found their way to England under this name; one of which may be *F. atroviridis* Jac. & Goepp.

gigantea, Regel in Gartenflora 1852, p. 21, t. iii. = **Furcraea tuberosa,** Ait. fil.

Jacobi (Versuch, etc. Sep. Abdr., p. 270) pointed out that this could not be *F. gigantea* and suggested that it might be *F. Selloa*, K. Koch; it was more probably intended for *F. tuberosa*, Ait. fil., and Jacobi would no doubt have recognized this had he seen good examples of the Kew "*tuberosa.*" Regel identified his plant with Roemer's "var. *Willemetiana*" of *F. gigantea*, which is simply a book adaptation of *Funium pitiferum*, Willemet (q. v.).

gigantea, Martius Fl. Brasil. iii. i. pp. 187–88 (c. 1855). = FURCRAEA GIGANTEA, Ventenat.

The remarks, however, cover *Furcraea tuberosa*, Ait. fil. as well.

gigantea, Grisebach in Fl. Br. W. Indies (1864). = **Furcraea tuberosa,** Ait. fil.?

The description, which is very brief and not altogether applicable, relates to *F. gigantea*, Ventenat, or rather to the older descriptions of that plant; but the only specimen actually seen by Grisebach was from Antigua, and was therefore in all probability F. *tuberosa*, to which, moreover the remarks apply directly.

gigantea,† Wettstein in Veg. Bild. S. Brazil tab. iv. (1906) non Ventenat. = FURCRAEA VALLECULATA Jacobi?

gigantea var. *Willemetiana*, M. Roemer in Syn. Ens. (1847). = *Funium pitiferum*, Willemet (infrâ).

Roemer's type, as regards distribution, covers both *tuberosa* and *gigantea*.

gigantea var. *Willemetiana*, J. G. Baker ex Kew Bulletin 1892, p. 101. = **Furcraea tuberosa,** Ait. fil.?

Reported from St. Vincent: Barbados specimens similarly

named in Herb. Kew. appear to be undoubtedly referable to *tuberosa*.

hexapetala† (Jacq.) Urban in Symb. Antill. iv. 152 (1903). = **Furcraea cubensis,** Ventenat (1793).

Jacquin's "*Agave hexapetala*" was undoubtedly prior to his "*Agave cubensis,*" but as Ventenat, when founding *Furcraea*, took up "*cubensis*" it must stand. Sintenis' 482 from Puerto Rico, cited by Urban, may be *F. tuberosa* Ait. fil.; it does not appear in any case to be *F. cubensis*, Ventenat. Of the localities given in the Symbolae, several undoubtedly belong to *F. tuberosa*.

interrupta,† Hort. van Houtte. ex Jacobi in Abhandl. Schles. Gesellsch. 1869, p. 169. = **Furcraea tuberosa,** Ait. fil.?

It is impossible to say what Jacobi's type of "*F. tuberosa*" (which consisted of leaves only) may have been; from the description it might be a plant collected on the Magdalena littoral by Purdie which has been discussed above under *F. spinosa*, Targioni-Tozzetti; Jacobi himself identified it with "*F. interrupta*" of Van Houtte's nursery at Ghent; and of that there is a photograph at Kew which represents apparently a state of *F. tuberosa*, Ait. fil.

Lindeni, Ed. André in Ill. Hort. xxi. 167 (1874). = **Furcraea** (Fourcroya) **Selloa,** K. Koch (1860)?

lipsiensis,† Jacobi (1869). = **Furcraea tuberosa,** Ait. fil.?

longaeva, Ed. André in Ill. Hort. x. Misc. p. 43, 370 verso. = **Furcraea** (Fourcroya) **Bedinghausi,** K. Koch.

macra,† Hort. Par. ex Jacobi (1869). = FURCRAEA (Fourcroya) DEPAUPERATA, Jacobi.

Noackii†, Hort. ex Baker in Bot. Mag. 6292 (1877). = *Agave Noackii*, Jacobi.

pubescens, Baker in Bot. Mag. 7250 (1892) vix Todaro (1879). = **Furcraea** (Fourcroya) **undulata**, Jacobi (1869).

pugioniformis,† Hort. Verschaffelt. ex Todaro (1876). = FURCRAEA (Fourcroya) ELEGANS, Todaro f. Todaro.

rigida,† Haworth (1812). = AGAVE RIGIDA, Philip Miller Gard. Dict. ed. viii. (1768) non Engelmann.

Engelmann supposed *Agave sisalana*, Perrine (the Sisal Agave of the Bahamas, East Indies, etc.) and *A. longifolia*, ("*A. elongata*," Baker in Kew Bulletin non Jacobi, the Yucatan "Sashqui") to be varieties of *A. rigida*, Mill., which was not in reality either of those plants. It is doubtful at present what *A. rigida* of Miller may have been, but it pretty certainly was not a *Furcraea*.

rigida,† Landry ex Jacobi (1867). = FURCRAEA (Fourcroya) DEMOULINIANA, Jacobi (1867) f. Jacobi.

Roezlii,† Ed. André in Rev. Hort. 1887, p. 353 fig. 71. = **Furcraea Bedinghausi**, K. Koch (1867).

Roezlii var. *atropurpurea*,† Hort. de Smet. ex Gard. Chron. 1876 (i.) 630. = **Furcraea** (Fourcroya) **undulata**, Jacobi?

sobolifera,† Hort. Cels. ex Jacobi (1867). = FURCRAEA (Fourcroya) DEMOULINIANA, Jacobi (1867) f. Jacobi.

spinosa, O. Targioni-Tozzetti (1808). = **Furcraea tuberosa** Ait. fil. (1818)?

Cf. at the same time, Purdie's Magdalena (Sta. Martha) specimens in Herb. Kew., which, if not the *F. elegans* of Todaro, may represent an undescribed species, or *F. spinosa*.

stricta, Jacobi (1867). = **Furcraea** (Fourcroya) **elegans** Todaro (1878).

tuberosa, Fenzl ex Baker in Gard. Chron. 1879, p. 623. = **Furcraea** (Fourcroya) **undulata**, Jacobi.

tuberosa, Belg. Hort. 1860 p. 219. = **Furcraea gigantea**, Ventenat.

tuberosa, Franceschi in Bailey Cycloped. Amer. Hort. ii. 620 (1900) vix Ait. fil. = **Furcraea** (Fourcroya) **Selloa**, K. Koch?

tubiflora,† Kunth & Bouché in Linnaea xix. p. 381 (1847). = BESCHORNERIA TUBIFLORA, Kunth Enum. v. 844.

vivipara,† Gard. Chron. (1869), p. 587. = **Furcraea tuberosa**, Ait. fil.?

No description given; shown at an International Horticultural Exhibition in Russia: probably was *Agave vivipara*, Maycock (which see above).

Watsoniana, Hort. Sander. ex Gard. Chron. 1898 (i.) p. 242 fig. 90 (p. 243). = **Furcraea gigantea**, Ventenat var. **Watsoniana.**

Inflorescence not seen; Mr. Watson considers this, as does the writer, to be a variegated form of the true *F. gigantea*.

FUNIUM *pitiferum*, † Willemet in Usteri Ann. xviii. p. 26 (1796). = **Furcraea gigantea**, Ventenat (1793).

The "Mauritius Hemp"; Willemet's account covers possibly both *F. gigantea* and *F. tuberosa*.

FURCRAEA *australis*,† Haworth Syn. (1812). = DORYANTHES EXCELSA, Correa in Linn. Trans. vi. 211 (1802).

Commelyni,† Baker in Amaryllid. (1888). = FURCRAEA (Fourcroya) CUBENSIS, Haworth var. INERMIS, Baker in Bot. Mag. 6543 (1 Feb. 1881).

cubensis,† Haworth (1812). = (pro parte) (1) FURCRAEA CUBENSIS, Ventenat (1793); (2) FURCRAEA TUBEROSA, Ait. fil.

cubensis,† Hasskarl in Retzia ii. 19 (1856). = **Furcraea tuberosa**, Ait. fil.

Hasskarl says that his plant, received at Buitenzorg from Groningen as "*F. tuberosa,*" squared exactly with Jacquin's description of *Agave cubensis* except that Jacquin gives the leaves as "ciliate-aculeate," which he says might be due to the description having been taken from imperfectly developed specimens in European gardens. Jacquin's description, written doubtless from the plant discovered by himself in Cuba, gives the leaf-margin as "ciliato-spinose," whereas that of *tuberosa* is "dentato-spinose." From Hasskarl's own description he had evidently before him *F. tuberosa*.

cubensis var. *Lindeni*, Kew Hand-List Tend. Monocot. 1897.	= FURCRAEA (Fourcroya) LINDENI, Ed. André (suprâ).
foetida,† Haworth (1812).	= **Furcraea gigantea,** Ventenat (1793).
gigantea, Baker in Amaryll. (1888).	= **Furcraea tuberosa,** Ait. fil.

The description belongs partly to *F. gigantea*, partly to *F. tuberosa*, but mainly to the latter.

tuberosa, Hasskarl in Retzia ii. 16 (1856).	= **Furcraea gigantea,** Ventenat.
FURCROEA *gigantea*, Redouté in Hist. Pl. Succ. (post 1806).	= FURCRAEA (Fourcroya) CUBENSIS var. INERMIS, Baker in Bot. Mag. 6543 (1881)?

The letter-press, as is carefully noted by De Candolle, is taken from Ventenat, but the plate differs somewhat; it may have been based on Jacquin's figure of *Agave foetida*, Linn., but it agrees, on the whole, with the form above noted.

gigantea, Redouté in Liliacées viii. 476 (1816).	= FURCRAEA GIGANTEA, Ventenat.

The text, however, relates partly to *F. tuberosa*, Ait. fil.

gigantea, Tussac in Fl. des Antilles (1818).	= **Furcraea tuberosa,** Ait. fil.

The figure is reproduced from the Plantes Grasses, and the Latin description is abridged from that of *F. gigantea*, Ventenat; but the French account by Tussac manifestly refers to *F. tuberosa* Ait. fil.

gigantea, Hook. in Bot. Mag. 2250 (1821).	= **Furcraea gigantea,** Ventenat (1793).
gigantea var.† Medley Wood in Gard. Chron. 1898 (i.) p. 227 non Ventenat.	= Furcraea (Fourcroya) Lindeni, Ed. André (suprâ).
Roezlia *bulbifera*,† Belg. Hort. 1883, p. 133 (nomen).	= **Furcraea Bedinghausi,** K. Koch f. Baker in Bot. Mag. 7170 (1891).
regia,† Hort. ex Baker in Bot. Mag. 7170 (1891).	= **Furcraea Bedinghausi,** K. Koch (1860).
Yucca *acaulis*, HBK.	= **Furcraea** sp. f. Trelease in Mo. Bot. Gard. Rep. xiii. (1902) p. 114.
argyrophylla, Hort. ex Baker in Bot. Mag. 7170 (1891).	= **Furcraea Bedinghausi,*** K. Koch.
Parmentieri, Hort. ex Baker in Bot. Mag. 7170 (1891).	= **Furcraea Bedinghausi,** K. Koch.
Pringlei † Greenman herb. ex Greenm. in Proc. Amer. Acad. xxxiii. p. 474 (1898).	= **Furcraea Bedinghausi,** K. Koch.

An abstract follows of those species that appear to the writer to be fairly established, and also of those which, though as yet not properly known, may be verified in the future, as against others, dealt with previously, which are either invalid, or unlikely to be identified. Notes are added indicating the supposed range of each species, or its origin, if known only in collections, and the approximate date of dis-

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* For a fuller extrication of *Furcraea Bedinghausi* synonyms under *Yucca* see Trelease on Yucceae in Mo. Bot. Gard. Rep. xiii. (1902) pp. 27–183.

covery or introduction. One plant (included in the Kew Garden Hand List of Tender Monocotyledons 1897 as *F. Desiderantii*) having died out is not accounted for in the preceding parts, and therefore omitted.

Admitted Species of Furcraea.

1. **tuberosa,** Ait. fil.—Haiti, and (introduced?) E. Antilles, about sea-level: before 1516,———.

2. **gigantea,** Vent.—Costa Rica, and (often introduced?) N. & S. coasts of S. America, 0–3000 ft.: 1529, Oviedo.

3. **elegans,** Tod.—Tobago, & N. E. Brazil to Colombia (cult.) about sea-level (?): 1648, anon. correspondent of De Laet (?).

4. **cubensis,** Vent.—Cuba (also cult. Yucatan),0–1000 ft.: before 1760, Jacquin.

5. **undulata,** Jacobi—Central America (?): introduced into English gardens before 1768 by Ph. Miller.

6. **longaeva,** Zucc. & Karw.—Mexico, Guatemala, & Bolivia* 9–10,000 ft.: before 1831, Karwinski.

7. **Selloa,** K. Koch.—Guatemala to Colombia, 3–9000 ft.: before 1860, Warszewicz (?).

8. **Bedinghausi,** K. Koch.—Mexico and adjoining Republics, about 6000 ft.: 1860, Roezl.

9. **albispina,** J. G. Baker—Native country unknown: Palermo Bot. Gard., before 1893,———.

10. **macrophylla,** Hook. fil.—Bahamas, etc. (an escape?): Morris, also Hart (before 1889); Colombia? Chile?

Imperfectly Known but Possibly Valid Species.

(a) *inermis,* J. G. Baker (pro var.) in Bot. Mag. 6543 (1881)—Venezuela (?): before 1688 (?),———.†

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* The Bolivia form, though of the same group with *longaeva,* may prove specifically distinct.

† If this was the "Aloe americana radice tuberosa minor non spinosa" of the Par. Bat. Prodr. of P. Hermann (ed. S. W. A. 1689): it may possibly also be the *Agave aspera* of Jacquin.

(b) *atroviridis*, Jacobi & Goepp.—Native country unknown: introduced into Belgian gardens before 1866,———.

(c) *Demouliniana*, Jacobi.—Colombia, 5–7000 ft. (?): introduced into European gardens before 1867,———.

(d) *Lindeni**, Ed. André.—Colombia 3–9000 ft.: 1868, Linden.

(e) *valleculata*, Jacobi—S. E. Brazil, about 3000 ft. (?): cf. Wettstein Veg. S. Brazil, pl. iv.

(f) *pubescens*, Tod. non Baker—Native country unknown: Palermo Garden, before 1876,———.

EXPLANATION OF PLATES.

The habit illustrations are from photographs made in Antigua by Mr. C. A. Barber in 1892, preserved in the Kew Herbarium. The others are from sheets in the same collection photographed by Mr. Hutchinson, of the Herbarium Staff, for this article. All are published by consent of Colonel Prain, the Director of the Royal Gardens, Kew.

Plate 1.—Acaulescent and shortly caulescent plants of *Furcraea tuberosa*, of various ages, on Antigua. The old plant shown at the left center has developed a rather long decumbent trunk.—Photographed by Barber.

Plate 2.—Leaf of *F. tuberosa*, from Grenada, Hutchinson, 1889, in Herb Kew., ×½ ±. Flowers (of *F. elegans* ?), from Tobago, Eggers, no. 5706.

Plate 3.—1, Inner leaf and bulbils of *F. tuberosa*, from the Grenadines group of islands, Smith Brothers, in Herb. Kew., ×⅓ ±; 2, Panicle fragment of *F. tuberosa*, from Antigua, Barber, 1892.

Plate 4.—*Furcraea tuberosa*, Ait., fil. Upper part of leaf, and flower, of the type sheet (from Bishop Goodenough's herbarium), from the first specimen known to have flowered in Europe; Kew Gardens, 1793, in Herb. Kew., ×⅔ ±.

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* If distinct from *Selloa* this may prove to be *flavoviridis*, Hook. which in that case should be restored as the name both of the Colombian plant, and of the variegated garden form.

FURCRAEA TUBEROSA.

FURCRAEA TUBEROSA (leaf) and F. ELEGANS (flowers).

FURCRAEA TUBEROSA.

FURCRAEA TUBEROSA.

BRANCH CANKERS OF RHODODENDRON.

BY HERMANN VON SCHRENK.

For a number of years the writer has observed a curious canker-like formation on branches of *Rhododendron maximum* throughout the Appalachian Mountains. These cankers appear in the form of large swellings of irregular shape. A number of these are reproduced on plate 5. In their simplest form, the swellings have a diameter in one direction two or three times the diameter of the branch on which they occur and anywhere from once to twice the thickness of the branch upon which they occur. In other words, they appear like flattened, more or less round, swellings. On one of the flattened sides, the swellings are covered with normal bark, and on the other side they usually show more or less well developed dead tissue, (figure 1, plate 5), and from this all the way to well marked holes, (figures 2, 3, 4 and 5, plate 5). These holes are sometimes so deep that the canker appears like a hollow cup. Not infrequently the cankerous formation takes place where two branches have diverged, (figures 3 and 4, plate 5), and in this case the dead, central tissue extends from one side to the other of the canker. Surrounding the dead portion a more or less vigorously formed callus covered with normal bark is found.

A large rhododendron shrub may have anywhere from one to forty or fifty of these cankers, sometimes two or three on one branch. The parts of the branch above and below the canker appear normal in every respect and usually are about the same size; in other words, the canker itself does not seem to materially influence the growth and development of the branch upon which it is situated. In this respect, these cankers differ very materially from cankers such as are caused by the various species of *Nectria*, or the various forms of fruit tree cankers. The rhododendron canker appears simply as a localized swelling, which does not seem to exert any influence upon the branch upon which it occurs.

A careful examination showed that cankers always originated around a small, dead branch. On plate 6, five stages of the canker development are shown. Figure 1 represents a living branch bearing a small, lateral branch which had recently died. Figure 2 shows a similar branch on which the lateral branch has been dead for a longer period, and figures 3, 4 and 5 show successive stages in the canker development. From an examination of an extended series of cankers in various stages, the conclusion is drawn that the development of these cankers was primarily due to an attempt on the part of the branch to heal over a dead branch stub. Woody plants, both trees and shrubs, differ very materially in the manner in which they heal over branch stubs. In the majority of forest trees, when a branch dies, the base of such a branch usually remains in a sufficiently intimate relationship to the parent branch so that the dead tissue is confined strictly to the branch up to the point where the living branch tissue comes into contact with the living tissue of the trunk or parent branch. In other words, that part of the branch situated within the trunk, to use a common expression, is supplied with water and food and remains alive. When the healing process begins, the tissue immediately surrounding the inserted branch starts to develop with greater rapidity, resulting in increased wood formation, and where the branch has broken off short, a marked callus soon arises which in time will cover the dead branch stub. The extent to which the tissue at the base of the branch stub assists in this healing process will vary considerably. In the genus *Picea*, for instance, the base of the branch stub remains alive for a very considerable period of time, giving rise to the well-known swellings commonly found on spruce trees at the base of dead branch stubs. Pines and many of the hardwood trees, on the other hand, form no such swellings at the base of the branch stub, because the branch in this case dies down close to the bark of the trunk. Owing to this difference in the behavior of the base of the dead branch, various species of forest trees heal over branch stubs with different rapidity and with varying degrees of success. In the white pine, for instance, a branch dies and in the course of time usually

breaks off close to the trunk or even within the bark layer of the trunk. A wound of this character then heals over rapidly. The same is true of trees like the beech, poplar and other hardwoods. In the case of the spruces, on the other hand, the base of the branch stub keeps on growing, and spruce trees are usually found with large numbers of dead branches extending out from the main trunk, and when these finally do break off, they break off two or three inches out from the trunk, and the healing, instead of taking place even with the surface of the trunk, takes place at a considerable distance out at the apex of a well marked cone.

The character of the healing is furthermore very considerably influenced by the rate of growth of the tree species. A rapidly growing tree will heal over branches very much more quickly than a slow growing tree.

In the case of the rhododendron cankers, one finds that when a lateral branch dies or where the leading shoot dies, the wood of the parent branch or trunk immediately surrounding the base of the dead branch likewise dies, and frequently for a very considerable distance from the base of the branch (see figure). The healing layer then starts to form at a considerable distance away from the base of the dead branch. The dead branches of rhododendron are very persistent; *i. e.*, they break off in such a manner that the dead stub is usually an inch or more in length. The rate of growth of the rhododendron is extremely slow, and it therefore takes a very long time for a branch stub to be completely healed over; so long, in fact, does this take that in the majority of instances the dead branch stub has begun to rot away long before the parent branch has succeeded in covering the stub. Figures 3 and 4, plate 5, show two of these branch stubs, both of which are gradually decaying. Owing to the slow growth of the rhododendron wood, the callous lips increase in size from year to year and gradually give rise to a small knot or swelling, (figure 3, plate 6), which increases in size as the

SECTION OF OLD CANKER.

branches grow older and ultimately large swellings are produced. In the older swellings, the small branch stub which gave rise to the swelling has by this time usually completely rotted away and the saprophytic fungi which brought about the decay of the small branch stub have usually by this time grown with considerable rapidity in the dead tissue on the surrounding base of the branch stub, so that in the course of time, deep holes filled with decayed wood matter result, (figure 5, plate 6, and figure 2, plate 5). It not infrequently happens that the healing callus is killed either by fungi, which have lodged in the developed canker, or by frost, and in such cases, a series of callous lips will appear in these older cankers, (figures 1 and 3, plate 5). Primarily, however, but one callous layer is found, and when this finally succeeds in healing over the wound, the cankers appear on the branch as small, round knobs, completely covered by normal bark. The text figure shows a longitudinal section of a canker in its later stages. From this, the relationship which the dead branch stub bears to the lips of the swelling will be perfectly evident.

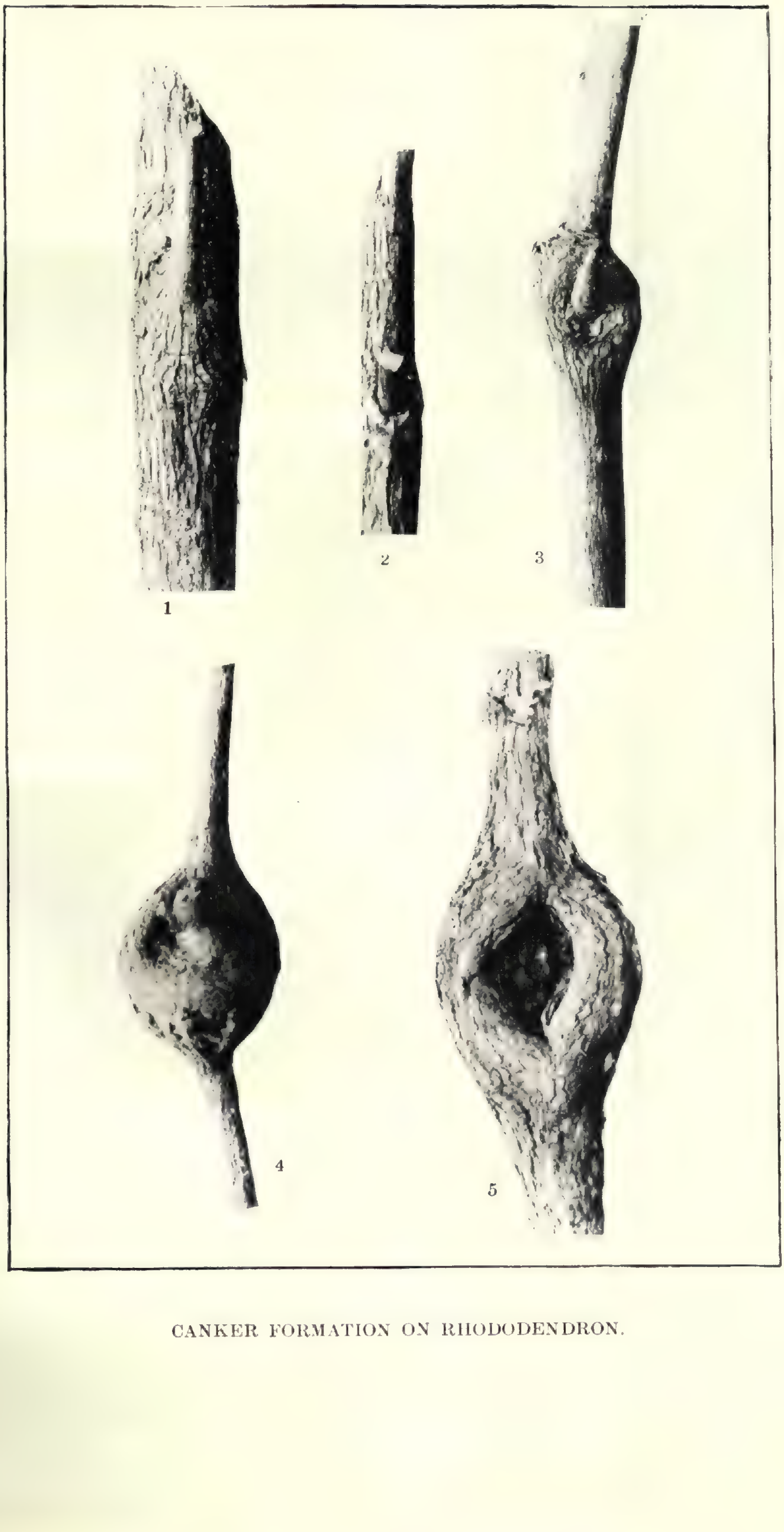
The formation of these branch cankers is presented as an interesting instance of the manner in which pathological conditions may arise in forest trees without the direct interference of other living organisms, either fungi or insects.

EXPLANATION OF PLATES.

Plate 5.—Cankers on rhododendron branches.

Plate 6.—Showing development of cankers around the base of a dead branch. Figures 1–5 show successive stages from the recently dead branch to the fully formed cankers.

CANKERS ON RHODODENDRON.



CANKER FORMATION ON RHODODENDRON.

ON FROST INJURIES TO SYCAMORE BUDS.

BY HERMANN VON SCHRENK.

The native forest trees of the temperate zone rarely show evidences of injuries due to frost. The reason for this is probably to be found in the fact that most buds start to develop at a period when severe frosts are no longer liable to occur. Frost injuries, such as are commonly found, usually occur in cultivated trees, particularly the fruit trees. Now and then, however, cold weather and heavy frosts occur during the late spring, and at such periods injuries are liable to be found in even the native trees. The extent to which native forest trees are subject to frost injury during the spring of the year is but little known at the present time. The spring of this year was characterized by extraordinarily cold weather and by heavy frosts, particularly during April and May. These frosts came at a time when buds on most trees had already begun to open, and in many instances trees had already formed leaves one to two inches in diameter. As is usual in such cases, fruit trees suffered very severely. The blossoms on apple and peach trees were almost universally killed throughout Missouri and northward, and in many localities in the Eastern States.

By the middle of May, most forest trees, especially maples, sycamores, elms, poplars, etc., had developed leaves of considerable size. After the last considerable frost, notes were made in the vicinity of St. Louis and in New Jersey concerning the extent to which the various species of trees had been influenced by the frost. With the exception of the sycamore, most trees showed but slight injury. Some of the youngest leaves were killed at the edges, but hardly any of them were killed outright. The young leaves of the sycamore, on the other hand, were very universally killed entirely. A few days after the frost, the edges of these leaves turned reddish and ultimately brown, and some weeks after, the leaves were thoroughly dry and papery. Many of the buds which were

just then opening were likewise killed, especially those near the outer ends of young branches. By the middle of June, the sycamore trees, which at this time of the year are usually well covered with leaves, appeared as bare as they do in February. The injury to sycamores noted about St. Louis occurred universally to a considerable distance south of St. Louis and as far east as the Atlantic seaboard, extending through Illinois, Indiana, Ohio, Pennsylvania, New Jersey and New York. For a month or more after the frost injury, there were no signs of development, and a cursory examination of the trees gave the impression that the trees had been killed outright. Small clumps of undeveloped leaves remained attached to the smaller branches and the trees had all appearances of having been severely frozen. By the end of June, many buds which had not been killed, started to develop. In most instances, these buds were confined to the lower ends of the branches; in other words, they consisted either of first or second buds, counting from the point of origin of the branch. (See plate 7, lowest branch to the left). These buds developed in the usual course into branches. The frost had evidently killed all of the outer buds and by the end of August, a large percentage of the sycamore trees showed long dead branches mixed in with the foliage which had developed since the end of June.

In numerous instances, all of the buds on the one year old branches had been killed. In such cases, one or more adventitious buds developed at the base of the branch, usually one on each side of its insertion (see plate 7, right side of figure). These buds developed with extraordinary rapidity, and by the end of August, the branches developed therefrom had the length commonly attained by branches developed from buds which had opened in a normal manner at the beginning of May. The conditions of several branches as they were found toward the end of August in northern New Jersey are illustrated on plate 7.

Sycamore trees by the end of August appeared as if they had less than half of the leaves usually found on the branches. The entire crown is filled with long, dead twigs around the base of which bushy masses of leaves have developed. The

injury, therefore, was simply a temporary one, and unless a similar injury is repeated during the next year, the trees will probably not have suffered permanently.

EXPLANATION OF PLATE.

Plate 7.—Branch of sycamore injured by frost, photographed two months after the injury.

FROST INJURY OF SYCAMORE.

THE GERMINATION OF HYDRASTIS CANADENSIS.

BY HENRI HUS.

Hydrastis canadensis L., popularly known as Golden Seal, Orange-root, Yellow Puccoon and by numerous other names, is one of our native plants of more than ordinary interest. Not only is it frequently planted in eastern gardens on account of its decorative effect and especially because of its crimson fruit, but as a plant of reputed therapeutic value it is often grown on a comparatively large scale for pharmaceutical purposes. This cultivation is becoming more important as the years go by. A vast army of collectors is scattered throughout the United States, gathering the plant in its wild state. A time will undoubtedly come when the supply from this source will fall far short of the demand, and when it will become necessary to take recourse to artificial sources to furnish the trade with the requisite amount.

The commercial article consists of the dried rhizomes, which are official in the Pharmacopoeia of the United States and in many other countries. Especially in Europe the greater value of Hydrastis in gynecological practice as compared with the various, frequently unreliable, preparations of Ergot, is becoming more and more recognized. The active principle contained in the rhizome is an alkaloid, hydrastine, which, according to Lloyd,* occurs to a lesser extent in the roots. Unfortunately for the grower, the propagation of this plant, as commonly practiced, is by means of division of the rootstock, and though a single one, four years old, may be divided into three or four pieces,† a considerable pecuniary

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* Lloyd, J. U. and C. G. Drugs and Medicines of North America. **1.** Ranunculaceae. 1884–85. Here a very complete list of the earlier pharmaceutical, medical and botanical literature of *Hydrastis* may be found.

† Rhizomes, six to ten years old, may possess from 20 to 60 fertile stems. — See Homer Bowers, A contribution to the life-history of *Hydrastis canadensis*. (Bot. Gaz. **16 :** 73).

Alice Henkel and G. F. Klugh, in Bulletin 51 of the Bureau of Plant Industry, U. S. D. A., mention that by a division of 40 plants, the next year 150 plants were obtained, an increase of 275%.

loss is involved in the perpetuation of the crop. Hence it has frequently been suggested that the seed should be used for purposes of propagation.

Though some have obtained excellent results from their efforts along this line, apparently the method has not commended itself to the majority, a variety of reasons having been assigned for the non-success. Two, most frequently brought forward, are the long time, *i. e.*, at least three years, which must necessarily elapse before a plant raised from seed has reached a marketable size, the other that either the seed refuses to germinate or that the young plants die shortly after germination.

Since *Hydrastis canadensis* does best in rich woods, of which large tracts may be had at a comparatively low rental, and, once planted, requires no care except an occasional hoeing,* the validity of the first objection may be questioned. As to the non-germination of the seed, this is a point open to discussion.

The seed must be obtained as early as possible. The Golden Seal ripens its fruit in July and August, the ovaries, which are present to the number of twelve or more, becoming crimson, one- or two-seeded berries. These are soon eaten by birds. The first thing to do then is to gather the fruit as soon as ripe. Leaving it in a shaded, well-ventilated place, the berries will soon dry, when the seed can be cleaned and at once sown. The importance of sowing fresh seed can not be too greatly emphasized; it is one of the essentials of success. In the case of many plants, horticulturists fully realize the necessity of sowing fresh seed only. This seems to be especially true of many members of the buttercup family. Hildebrand† points this out for the genus *Anemone*.

In sowing, the necessity of reproducing as nearly as possible natural conditions, must be remembered. This has sufficiently been shown by a number of investigations of which it is only necessary to mention those of the late B. Schmid,‡

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* Bowers, H. *l. c.* p. 81.

† Hildebrand, F. Einige Beobachtungen an Keimlingen und Stecklingen. (Bot. Zeit. **50 :** 1. 1892).

‡ Schmid, B. Beiträge zur Embryo-Entwickelung einiger Dicotylen. (Bot. Zeit. **60 :** 207. 1902).

who studied the germination of *Eranthis hiemalis, Corydalis cava, Ranunculus Ficaria, Bunium Bulbocastanum* and *Cyclamen persicum.* From his experiments it becomes apparent that the medium is of but little importance as long as proper conditions of temperature and moisture obtain. The protective action of woods, preventing extremes of temperature and moisture, has been shown by Ebermayer,* who is quoted by Schmid in the paper just mentioned. Comparative observations made in Europe, in a beech-forest situated at an altitude of 400 m., gave the following results:

TABLE A.

SOIL AND SURFACE TEMPERATURES.

	In the wood.		In the open.	
Temperature	max.	min.	max.	min.
At surface	21.5°		28.6°	
One-half foot below surface	18.4°	–2.5°	24.5°	–4.6°

From this it will be seen that at the surface the highest temperature was 7.1° higher in the open than in the wood, while ½ foot below the surface a difference of 6.1° C. was found. It will also be noted that in winter the temperature of the soil ½ foot below the surface was considerably higher in the wood than in the open.

Of paramount importance to the modified temperature of the forest, is, as Schmid points out, the fairly uniform humidity of its soil. In the woods there is but little danger of desiccation as a result of prolonged summer-drought, which in the open occasionally affects even the deeper layers of soil.

In the wood, the natural habitat of *Hydrastis canadensis,* where the ground is covered first by a layer of dry and decaying leaves, and secondly by a layer of leaf-mold, the seed of this plant evinces no trouble in penetrating to a depth of several inches. To insure germination, similar conditions would probably have to be reproduced. However, it remains

* Ebermayer, E. Die physikalischen Einwirkungen des Waldes auf Luft und Boden etc. 1. Aschaffenburg. 1873.

a question what depth is the best suited to this purpose. With this in view, an experiment was undertaken in the fall of 1906.

Having obtained fresh seed from the vicinity of St. Louis, through the kindness of Mr. O. S. Ledman of the Luyties Pharmaceutical Co., it was sown on August 15, 1906, in lots of 25 in 5-inch pots, containing a mixture of equal parts loam, sand and leaf-mold, which filled the pots to within one inch from the top. The seed was then covered by ½ inch of the same mixture. Eight pots, thus prepared, were arranged in a box in such a manner that the surface of the soil in the first pot was exactly ½ inch, and that of the soil in the eighth pot was exactly 7½ in. below the top of the box, and the seeds

TABLE B.

Depth in inches below surface.	Number germinated.		Not germ. but in good cond.		Total germ. or in good cond.		Number decayed.	Number not acc. for.	Total number dec. or not acc, for.	
	No.	%	No	%	No.	%			No.	%
1	2	8	0	0	2	8	6	17	23	92
2	10	40	1	4	11	44	12	2	14	56
3	12	48	0	0	12	48	8	5	13	52
4	6	24	3	12	9	36	16	0	16	64
5	14	56	0	0	14	56	7	4	11	44
6	8	32	1	4	9	36	10	6	16	64
7	14	56	0	0	14	56	11	0	11	44
8	8	32	0	0	8	32	13	4	17	68

RESULTS OBTAINED BY SOWING SEEDS OF HYDRASTIS IN LOTS OF 25 EACH AT DEPTHS VARYING FROM ONE TO EIGHT INCHES.

respectively 1 and 8 inches below the top. The other pots were so placed between these two that each stood exactly one inch lower than did its predecessor. The remaining space was then filled with a mixture of leaves and old horse-manure containing much straw. The box was placed in a well-drained cold frame. After the cold weather set in, the frame was covered during the night with a sash, which was always removed during the daytime, except when extreme cold prevailed, or during heavy snow or rainstorms. Thus it was hoped to reproduce natural conditions as advantageously as possible. The box was watered slightly from time to time, as was deemed advisable.

On February 12, 1907, the pots were removed from the box and the seeds were counted, the fact whether they had germinated or remained unchanged, externally at least, or had decayed, being noted. The results obtained are shown in the accompanying table (B) and diagram (I). In the latter, the ordinate gives the number of seeds and the abscissa the number of inches below the surface of the soil at which the seed lay. The number of seeds germinated is shown by a full line; the number germinated or in good condition at the end of the experiment, by a dotted line; and the total number decayed or unaccounted for, by a broken line.

It will be noted that of the seeds placed 1 inch below the surface but 2 germinated and but 6 decayed seeds were found, 17 remaining unaccounted for. It may be assumed that in the case of the latter, decay had progressed so far as to make them unrecognizable.

In the case of the second pot, in which the seed had remained 2 inches below the surface of the mulch, 10 seeds had germinated, one was found not to have germinated but to be still in good condition, while 12 were found to be decayed and 2 were unaccounted for.

Where the seed had been buried 3 inches below the surface, 12 seeds were found to have germinated, 8 were decayed and 5 unaccounted for.

In the next pot but 6 seeds had germinated, 3 were found to have remained apparently unchanged, while 16 were found to have decayed.

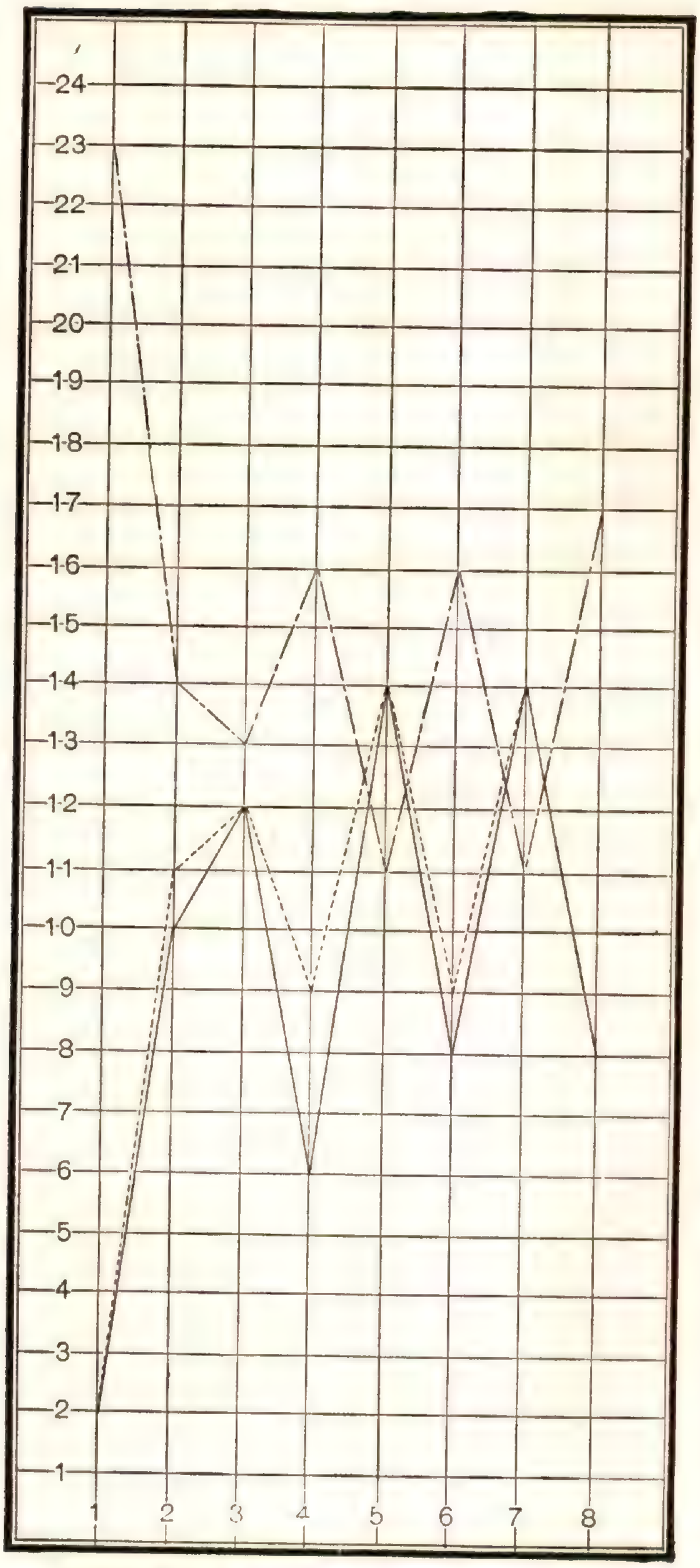
The pot in which the seed had been placed 5 inches below the surface, showed that 14 had germinated. Seven decaying seeds were found, no trace of the other four remaining.

In the sixth pot 8 seeds were found to have germinated, 1 having remained unchanged, 10 being decayed and 6 unaccounted for.

The conditions met with in the fifth pot were again encountered in the seventh pot, with the exception that all decayed seeds could be counted.

The last pot yielded 8 germinating seeds and 13 decayed ones, 4 being unaccounted for.

DIAGRAM I.



RELATIVE NUMBER OF SEEDS OF HYDRASTIS WHICH GERMINATED OR DECAYED AT VARIOUS DEPTHS.

The experiment was conducted on too small a scale to attach any great importance to the fluctuation in the percentage of germination obtained at various depths. The low germination percentage at 6 inches below the surface appears inexplicable. It is different with the low percentage of germination obtained in the case of the fourth pot, which occupied the frost line, as was determined by repeated observations. The results obtained with the second and third pots, respectively 40% and 48% germinated, and 44% and 48% either germinated or in good condition, compared with the results yielded by the fourth pot, 24% germinated and 36% germinated or in good condition, might lead one to believe that a position of the seed where it is exposed to a protracted low temperature, but not subject to repeated thawing, is less detrimental than a position where it can be reached only by a rather severe frost, coming in the middle of the winter but where the seed has already received the benefit of the higher temperature of the deeper soil-layers.

Not taking into account the results obtained with the first pot, the average percentage of germination obtained is over 40%. From this it may be concluded that there is no valid reason why Golden Seal should not be raised from seed, provided fresh seed is used, which, when in the soil, is protected from extremes of temperature. For practical purposes it would be best to sow the seed in a well-drained frame, in the soil, not in pots. The soil should be a mixture of loam, leaf-mold and sand, and be at least one foot deep. . The seed is to be covered with at least $\frac{1}{2}$ inch of the same mixture and the whole mulched to a depth of 6 inches. Sufficient protection to keep the frost from the seed must be given during the coldest winter weather. In the early spring the mulch is to be removed.

The development of *Hydrastis canadensis* was fully described some years ago by a practical grower, Mr. Homer Bowers.* In this paper is given a detailed description of the condition of the plants during the first year of their existence, a condition which is similar to that met with in

* Bowers, H. *l. c.* p. 74.

*Eranthis hiemalis** and others. The similarity between the first-year stage of this plant and that of the May-apple, *Podophyllum peltatum*, is pointed out by Holm.†

Both have the peculiarity that during the first year of their development the plants rely entirely upon the cotyledons for that portion of their food which they must obtain from the air. These cotyledons are in evidence only during a few months and disappear during the summer. Here must be sought one of the reasons for the apparent non-success of the propagation by seed of the plant under discussion. Too readily the conclusion will be arrived at that the plants have died.

When, in the frame, some time after the mulch has been removed, the cotyledons make their appearance, it becomes necessary to provide shelter from the sun's rays and the drying effect of the wind. Screening is essential. Watering is necessary only when the soil threatens to become too dry. The screening must be continued during the summer, even after the seed-leaves have disappeared, and the soil must never be allowed to become dry. At the approach of winter a light mulch of leaves must be put on, and during the coldest weather some protection is to be given. The next spring, as soon as danger of extreme cold weather is over, the mulch can be removed, and each plant will produce a single leaf. The plants can remain in the frames during the summer, with the necessary sheltering and watering, and an occasional application of manure water early in the year. About August the plants can be removed to their permanent location and the frames prepared to receive the next lot of seed. Using a double set of frames, the growing of *Hydrastis* from seed will be a matter requiring but little space and less work, which after the first three years may be considered to yield a return equal to that part of the crop formerly retained for propagating purposes minus the rental of the extra land needed.

Though the number of papers dealing with *Hydrastis canadensis* is limited, from a morphological, anatomical and taxonomic standpoint the plant has received a very thorough

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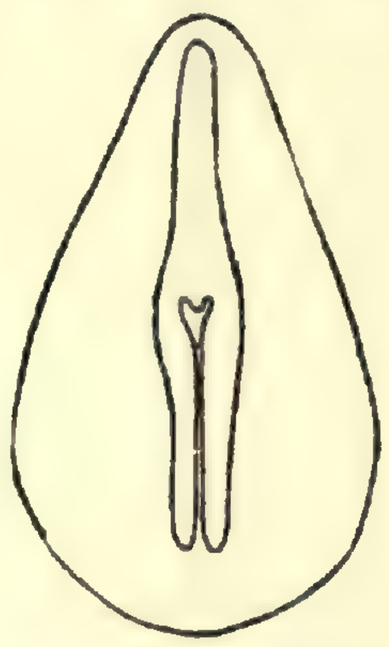
* Irmisch, Thilo. Ueber einige Ranunculaceen. 3. (Bot. Zeit. **18**: 221).

† Holm, Theo. *Podophyllum peltatum.* (Bot. Gaz. **27**: 419).

treatment. Especially worthy of note are, besides the articles referred to above, those of Asa Gray,* Prantl,† and the excellently illustrated and thorough treatment of Pohl.‡ At the same time, but little appears to have been published on the details of the germination, the various authors contenting themselves with descriptions and drawings of the mature seedling. For this reason use was made of the ample material at hand to furnish the plate accompanying this article.

The 12-20 spirally arranged and fleshy carpels of the single terminal flower of the Golden Seal are crimson when ripe and contain either one or two seeds. The latter are ovoid, with an average length of 3 mm., are provided with a black, hard and shiny coat and contain a fleshy albumen and a minute embryo (figure), the whole arising from an anatropous, pendulous ovule with ventral raphe.



SECTION OF SEED ABOUT TO GERMINATE.

Under natural conditions the seedlings appear in the last week of April or in the early part of May. They consist of a primary root provided with 5-6 lateral rootlets and 2 pale-green cotyledons on a short hypocotyl. The latter are petiolate, finely hirsute on both surfaces and possess one median and two lateral nerves originating at the base. Their shape is ovoid with a notched and sometimes mucronate tip. The average length is 15 mm. with a width of 10 mm. The petioles are from 25-30 mm. long and are slightly channelled, being hirsute like the cotyledons. The hypocotyl is about 5 mm. in length.

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* Gray, A. Genera of the Plants of the United States. Boston. 1848.

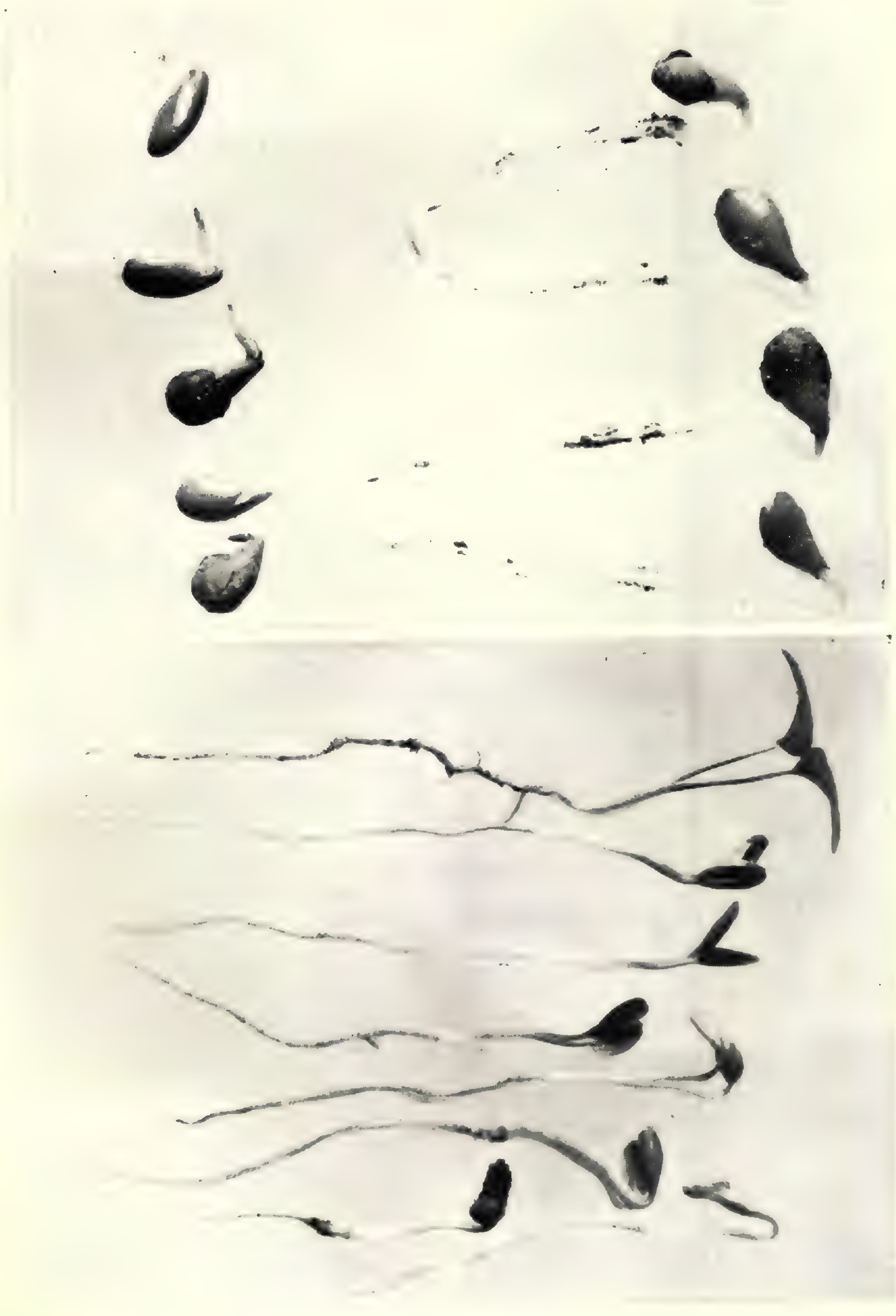
† Prantl. Beiträge zur Morphologie und Systematik der Ranunculaceen. (Bot. Jahrb. **9**: 225. 1888).

‡ Pohl, Julius. Botanische Mitteilung über *Hydrastis canadensis*. (Bibl. Bot. **6**[29]. 1894).

When the seedling becomes older the plumule may be recognized between the two cotyledons. This ordinarily does not develop until the second year. For this and later stages the reader is referred to the papers quoted above, especially to that of Julius Pohl.

EXPLANATION OF PLATE.

Plate 8.—*Hydrastis canadensis*. Germination stages, × 2; and more advanced seedlings, natural size.



GERMINATION OF HYDRASTIS.

AN ABNORMAL ODONTOGLOSSUM CERVANTESII.

BY HENRI HUS.

The flowers of *Odontoglossum* seem frequently to be subject to malformation. Penzig, in his Pflanzen-Teratologie, quotes numerous cases for different species. Had it not been for the fact that the case here brought forward presents some aspects not ordinarily met with in the teratology of *Odontoglossum* flowers, a brief notice elsewhere would have been considered sufficient.

Among the plants of *Odontoglossum Cervantesii* cultivated in the orchid house of the Missouri Botanical Garden during 1906, was one which bore, upon one of the scapes, five flowers one of which was abnormal, the one here used for purposes of illustration. The abnormality showed itself in the first place in the wings of the column which had become enlarged and were provided with coloring matter. The column bore three hoods with anther cases. Apparently but five floral segments were present. Two (pl. 9, 1, 2) of these were oval-oblong and, on account of their contour, were at once classed as sepals. Two others (pl. 9, 3, 4) were broader and possessed a more or less undulate margin. There was no difficulty in recognizing them as petals. The fifth segment (pl. 9, 5) was in form intermediate between petals and sepals and, at the time, was classed as a petal, chiefly because of its position. It had to be assumed that the labellum was under-developed.

However, during 1907, the same plant again produced abnormal flowers, and observations made on these caused a change in the views just expressed. The plant bore four scapes, the flowers of three of these being normal. The fourth scape produced five flowers, of which only the terminal one was normal, the four others being more or less malformed.

The flower lowest on the scape had three sepals and but one petal, the labellum, which appeared normal. On the other hand, the upper sepal was twice as broad as normal. The column was abnormal, the wings being absent. There were two anther cases instead of one, each enclosing but a

single pollen mass. The stigma was rather smaller than normal.

The second flower was normal except for the right hand petal, which had grown fast to the column. The right wing of the column was three times as large and situated higher than the normal left wing. The stigma was abnormally elongated. There were two single pollen masses, abnormally large and not enclosed in the anther cases. The latter were rudimentary and situated at some distance at the back of the column.

The third flower was normal except for the left petal, which had grown fast to the column.

The fourth flower possessed all its parts but the right petal was fused with the labellum and also with the column. On that side the wing of the column was missing.

In view of the structure of these abnormal flowers it would perhaps be better to interpret the flower here illustrated as having three sepals, 1, 2 and 5. The two petals remain 3 and 4. To account for the sixth segment one would have to assume that the labellum had become fused with the column. This would help to explain the anomalous position of the sepal 5. What further lends color to this is the fact that the wings of the column are not only enlarged but also are provided with coloring matter, something which normally is not the case.

As far as our experience goes, it would seem that the amount and position of the color in the floral parts of *Odontoglossum Cervantesii* and its varieties is quite constant. Nearly a century has elapsed since the species was brought from Mexico. It is of easiest culture and opportunity for observation has been ample. From time to time there have appeared plants which differed from it in a few characters, and which have been given either specific or varietal rank. The more conservative authors of the present day recognize beside the species but three varieties, *i. e.*, var. *majus*, var. *decorum* and var. *Andersonii*, the differences lying chiefly in the size of the flower and in the shape, color and markings of the segments. It appears that these characters, and especially the markings, which consist of narrow bands and sometimes spots of red at the base of the petals and sepals and which

sometimes occur in other places, are considered quite constant. Interesting in this connection is the opinion expressed by that eminent Belgian horticulturist, Charles Lemaire,* who was inclined to believe that intensity of color and size of flower depended on locality, greater or lesser intensity of heat and light and the relative time of flowering. He says: "Comme chez la presque totalité des plantes de cette curieuse famille, les dimensions des fleurs et l'intensité de leurs coloris paraît beaucoup varier: circonstances qui semblent dépendre uniquement de la station, des sommes diverses de la chaleur et de la lumière, et des époques relatives où se montrent les fleurs, c'est-à-dire plusieurs fois dans la même année."

While the above may be considered an argument for or against the theory of the constancy of varieties, in view of our experience with other varieties of widely different species, the present attitude towards *O. Cervantesii* and its immediate relatives may be considered correct. But it is of interest to note that, in the plants of *Odontoglossum Cervantesii* grown in the Missouri Botanical Garden, the coloring of the labellum seems to vary considerably in plants growing under identical conditions and flowering at the same time. While in one flower the labellum may be pure white, another flower on the same plant may have a labellum with one bar in front of the crest, while others again may show two, three, or even more bars, sometimes with the addition of one or more red spots.

EXPLANATION OF PLATE.

Plate 9.—Abnormal flower of *Odontoglossum Cervantesii*, × 2. In the center the entire flower: the other figures are parts of the same flower dissected. 1, 2. Sepals. 3, 4. Petals. 5. Column with a sepal attached. 6. Portion of enlarged wing of column, broken off.

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* Illustration Horticole. **1 : 12.** 1854.

ABNORMAL ODONTOGLOSSUM CERVANTESII

VIRESCENCE OF OXALIS STRICTA.

BY HENRI HUS.

Specimens of *Oxalis stricta** with bright green petals were for the first time observed in the early part of September, 1906, in the immediate vicinity of St. Louis, in an unused portion of Bellefontaine Cemetery, not far from Florissant Avenue, which skirts its southeastern boundary. For the sake of convenience these plants are designated as *Oxalis stricta viridiflora*. Their discovery was entirely accidental, for the plants were few in number, certainly not more than twelve. Interspersed with normal plants of *Oxalis stricta* and grasses, they formed a patch not larger than eight square feet. The spot was revisited several times during the fall of the same year and during 1907. Specimens gathered on these trips as well as plants raised this year from seed collected last fall, yielded the material on which this paper is based.

With the exception of the petals and perhaps of the fruit, the plant agrees in all respects with the published descriptions of *Oxalis stricta* L. The plants are equally vigorous, but both flowers and fruit are smaller. The average length of 100 nearly ripe fruits of *O. stricta* collected in the vicinity of St. Louis, was found to be 17 mm.; the average length of 100 petals of the species collected in the same neighborhood and in spring was 8 mm., of the same number, from the same locality but collected in fall 6 mm. The same measurements made on parts of *Oxalis stricta viridiflora*, yielded respectively 12, 6 and 5 mm.

A microscopical examination of petals and sepals of the species and its variety overthrew a preconceived notion as to their minute structure, an opinion based on studies of *Epilobium hirsutum cruciatum*, *Oenothera Lamarckiana cruciata* and others.† It was expected that since the petals had

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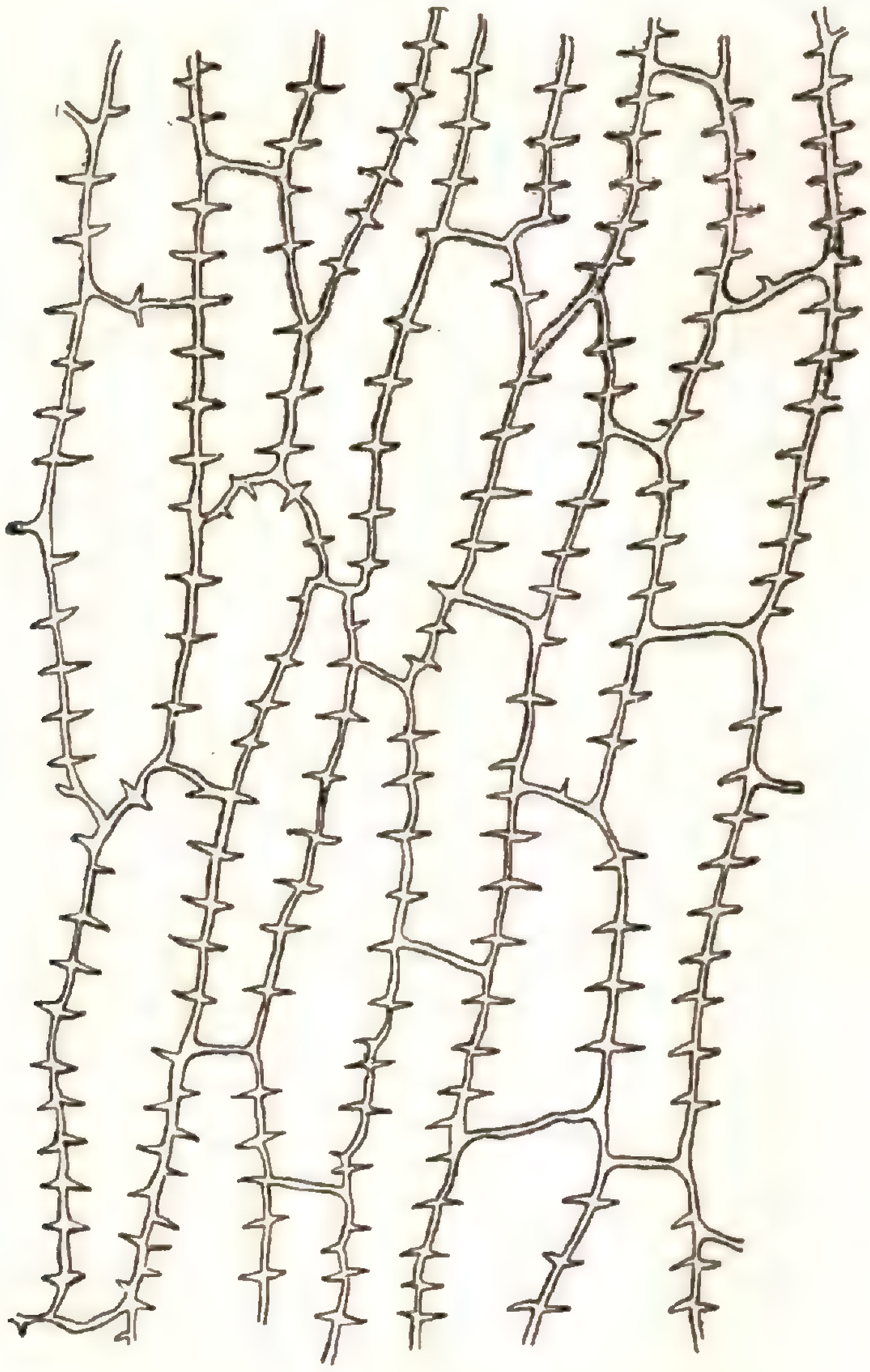
* This is *Oxalis stricta* as represented in the Linnaean Herbarium, according to Small (Bull. Torr. Club. **23**: 267) and Robinson (Jour. Bot. **44**: 386), though not of most English and American writers. It is the *O. corniculata Dillenii* of Trelease in Syn. Fl. N. Am. **1**[1]: 365.

† De Vries, Hugo. Die Mutationstheorie. **2**: 593.

assumed the color of the sepals, even though not the form, they would likewise have acquired other characters which particularly distinguish the sepals.

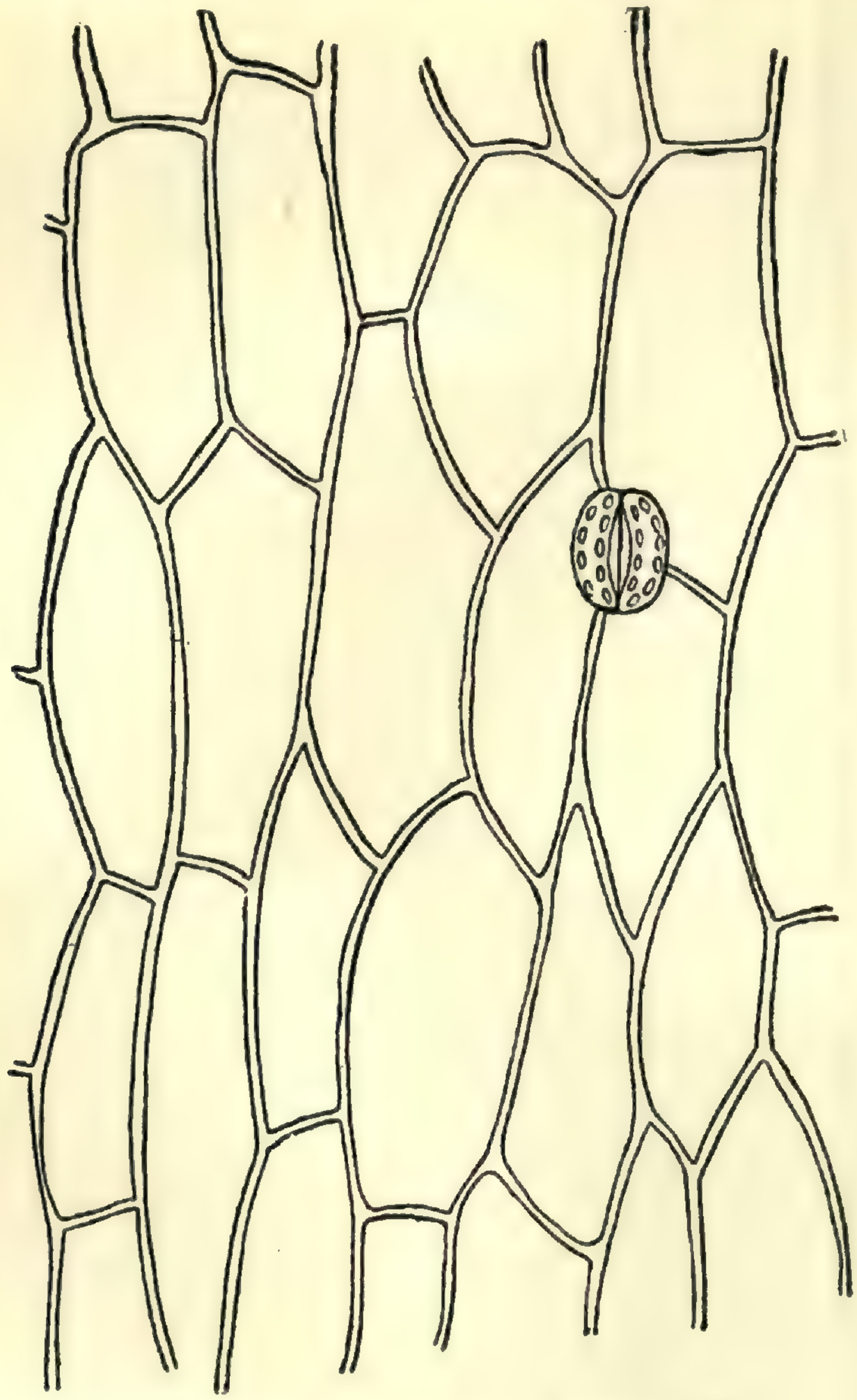
The normal petal of *Oxalis stricta* is yellow and obovate, with a more or less undulate margin. It is frequently slightly notched at the top. The vascular bundles branch and spread



1. NORMAL PETAL, NEAR TIP, × 400.

like the sticks of a fan, adapting themselves to the outline of the petal. The exterior surface, seen under a low power, shows nothing but the distribution of the vascular bundles and the presence of a few hairs near the tip. These hairs, on greater magnification, are shown to be of two kinds, the one

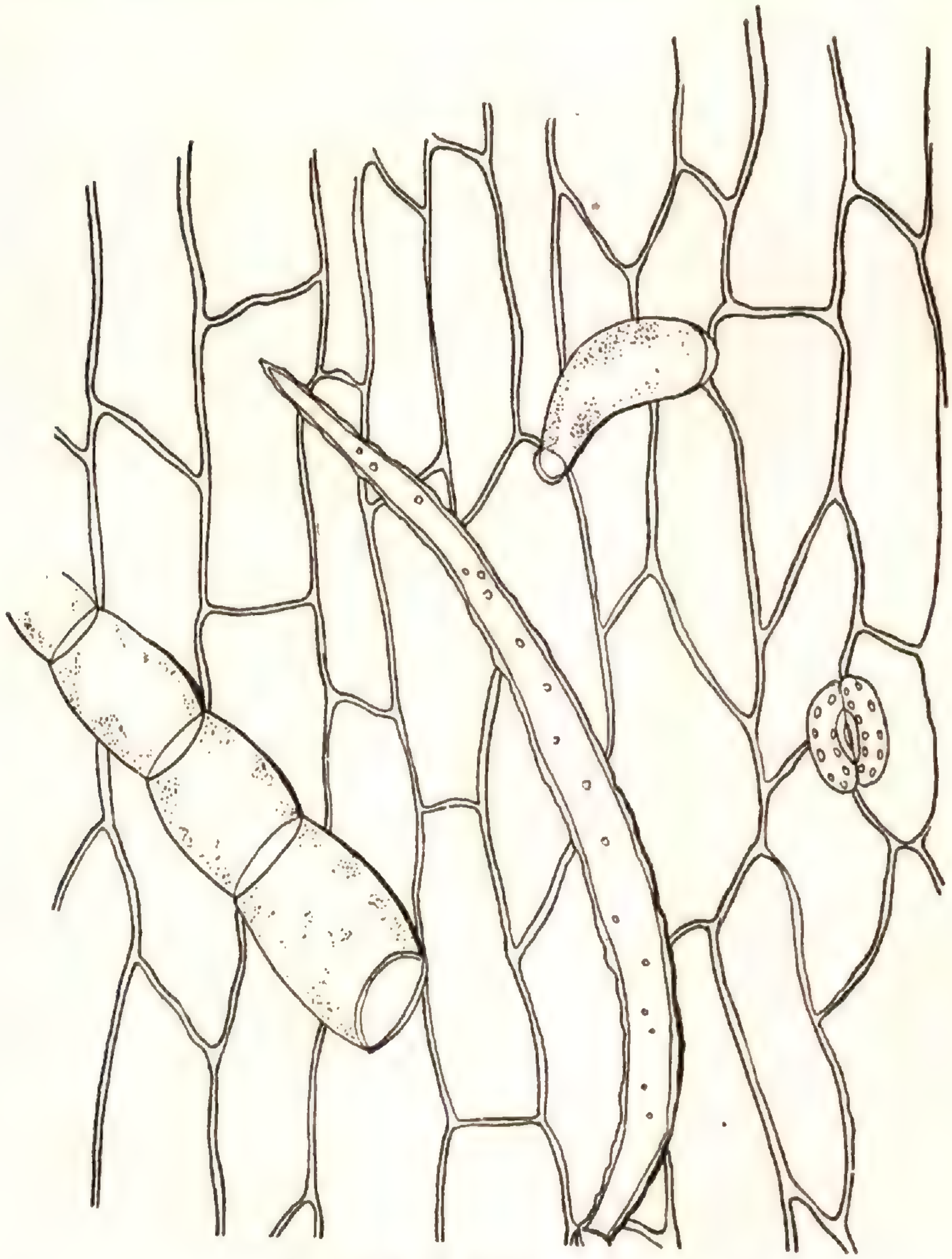
pluricellular and thin-walled, the other unicellular, with thicker walls covered by numerous wart-like projections. The cells of the epidermal layer of the petal are longer than broad and possess projecting ridges (fig. 1). They are prolonged into blunt papillae. Epidermal cells with smooth walls are



2. NORMAL PETAL, NEAR BASE, × 400.

found near the base and especially in the neighbourhood of the vascular bundles (fig. 2). Occasionally a stoma is seen. The interior surface of the petal does not really differ from the exterior surface.

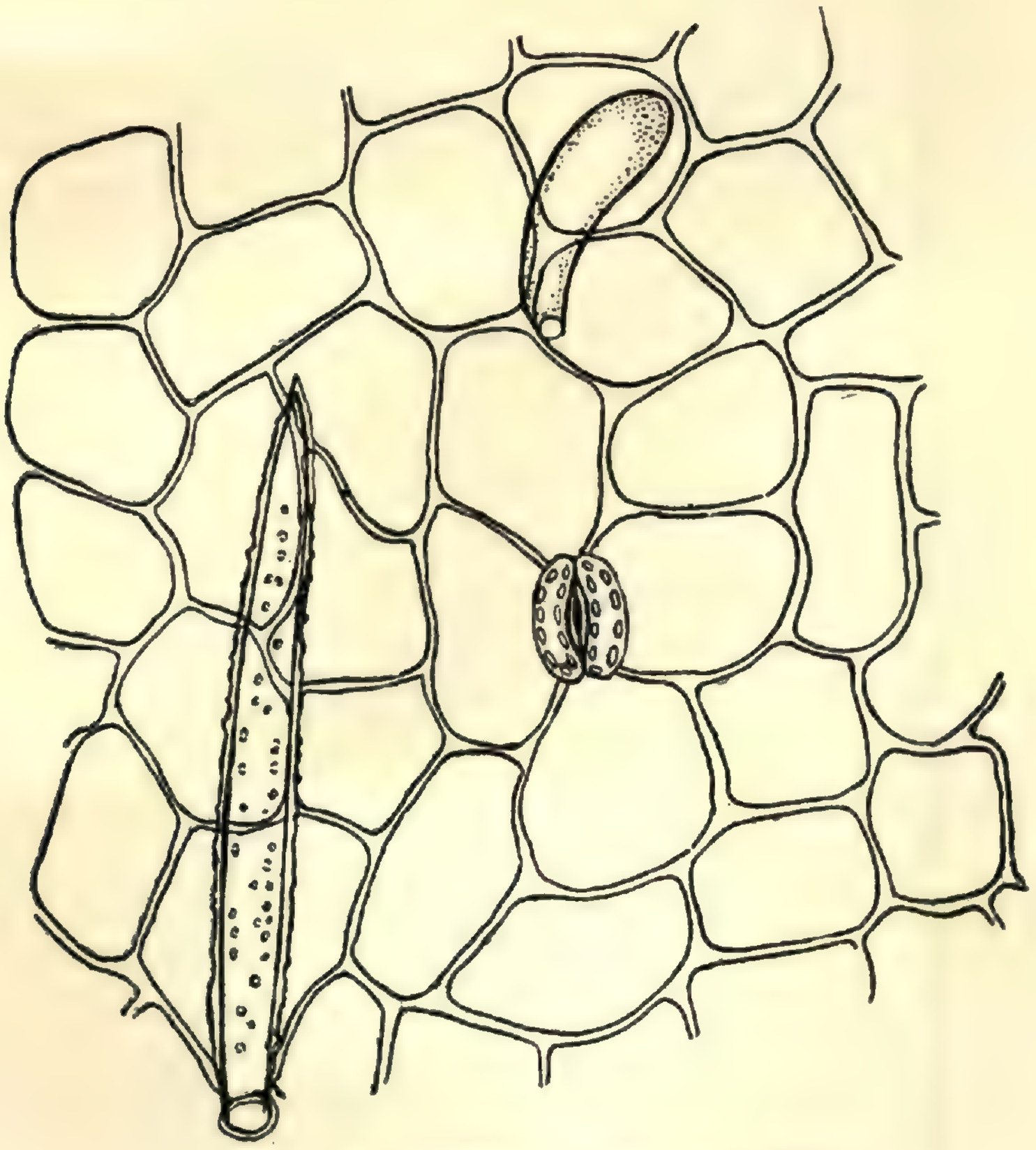
The sepal of both normal and virescent *Oxalis stricta* is green, oblong, with smooth edges. The venation is practically parallel. The exterior surface of the sepal shows a number of hairs. distributed over the entire surface. They are of three



3. BACK OF SEPAL, × 400.

kinds (fig. 3), the different kinds occurring with different frequency. Most numerous are the long and thick-walled unicellular hairs which occur from the base to the tip. At the

latter point there are so many of them as to form a small fringe. These hairs are appressed and identical with the appressed hairs on other portions of the plant. Less numerous are the very short, more or less pear-shaped, unicellular hairs Very unfrequently a thin-walled, one- or several-celled hair is met with. These hairs are identical with those which may be observed, with the naked eye, on the stem, etc.,



4 BACK OF VIRESCENT PETAL, × 400.

and which often give a woolly appearance to some portions of the plant. Stomata are quite frequent. Numerous crystals of calcium oxalate can be seen. The cells, which are longer than broad, possess smooth cell walls. The ridges, so marked in the cells of the epidermal layers of the petal, are entirely absent. The interior surface of the sepal shows as a rule no hairs, though occasionally one of either of the three

kinds just described may be met with. The stomata are less numerous.

The petal of *O. stricta viridiflora* is green in color, and obcordate, with an undulate margin. The distribution of the vascular bundles is in accord with the outline of the petal. The exterior surface shows a limited number of hairs. These are situated along the margin of the tip. The large unicellular thick-walled kind is most frequent. Next in frequency comes the small, unicellular thin-walled hair. Multicellular hairs are rare. The epidermal cells (fig. 4) entirely lack the projecting ridges of the cell walls of the epidermal layer in normal petals. While near the base the cells are longer than broad, near the tip the cells are more or less isodiametric. Often the upper surface of these cells forms blunt papillae. Stomata are more numerous than on the normal petal of *O. stricta*. On the inner surface of the petal of the variety, there are no hairs and the stomata are few.

Thus far then, the petal of *Oxalis stricta viridiflora* differs from the normal petal of *Oxalis stricta* in the following particulars, *i. e.*, color, width, distribution of vascular bundles, shape of the epidermal cells, absence of ridges in the latter, number of stomata, and in the possession of hairs of the unicellular, thin-walled type, as well as a slight increase in the total number of hairs. But the internal structure shows further differences. While the petal of *O. stricta* is but a few cells thick, that of the variety is much thicker, and the tissue is composed of several layers of cells much smaller than those of the epidermis. These small cells are filled with chlorophyll granules. Any attempt to demonstrate the presence of xanthin in the cells of the petals of the green-flowered variety was unsuccessful.

Though in many respects the petals of this virescent form approach the sepals in structure, they do not represent marked sepalody as it is presented in certain Onagraceae,* for example, while their shape, instead of approaching that of the sepals, deviates widely from it.

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* Hus, Henri. Over sepalodie van de kroonbladen van Oenothera-soorten. Avec un résumé en langue française. (Botanisch Jaarboek. Gent. 1904).

The flowers of normal *O. stricta* open widely on bright mornings and close at noon. The flowers of *O. stricta viridiflora* never open widely, but on the other hand are but little influenced by the amount of light. They open in the morning and never close, something very different from what happens in *O. stricta*. Here the petals close over the young fruit, and sooner or later become loosened at the base. Frequently they form a cap which is carried up on the tip of the growing fruit, where they may remain till maturity. In the variety *viridiflora*, however, the petals persist, in good condition, for a long time, often till the fruit is nearly ripe (plate 11). This agrees with the observations of others in similar cases.*

The fertility of the variety does not appear to have been impaired, since both in 1906 and 1907 seed could be gathered in large quantities. It is absolutely self-fertile, as will be shown later. An attempt to distinguish plants by relative lengths of stamens and styles yielded no satisfactory results.

When the plants of *Oxalis stricta viridiflora* were met with for the first time, it was thought that the green color of the petals was due merely to a passing virescence and that the green-petaled strain might perhaps be propagated in a vegetative manner. This, experience has shown us to be possible for frondescence not caused by parasites† such as is met with in the green rose and wheat-ear carnation. For this reason, in September, 1906, a few plants of the variety were transported to the Missouri Botanical Garden, where they were kept in pots in a cold frame over winter. The attempt met with but indifferent success. During October and November a few small, green-petaled flowers made their appearance. In the spring the single small plant which survived was transplanted to a frame and there produced a few flowers, all green. At no time was there material for purposes of vegetative propagation, and finally the plant died.

This was no great loss, since it was found that in the spring of 1907 a number of green-flowered specimens had again ap-

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* Masters, M. T. Vegetable Teratology. 241.

† De Vries, Hugo. Een epidemie van vergroeningen. (Botanisch Jaarboek. **8**: 66. 1896).

peared in the old locality. Besides, the interest was centered in the seedlings obtained from a small amount of seed gathered in the fall of 1906 on green-petaled plants in Bellefontaine Cemetery. In the spring all seed was sown in sterilized soil. The seedlings which appeared were first transplanted to a flat, which was placed in the screenhouse.* Forty-four seedlings in all made their appearance. One of these died. The remaining 43 were transplanted just at the time when they commenced to flower. With one exception, all bore the green-petaled flowers. There was but one plant which bore yellow flowers. Already in its earliest stages it could be distinguished from the others by its darker, somewhat brownish foliage. How to account for this plant is difficult. Insufficient sterilization of the soil is a possibility which can safely be excluded. Numerous control experiments have proven this. Besides, had such been the case, seedlings of other plants might have been expected to make their appearance. There remain two possibilities. Either the plant is the result of a cross or the seed was accidentally mixed at the time of collection. At least another year will be needed to settle this question with any degree of certainty.

Engelmann, † in his classical treatise on plant teratology, distinguishes two classes of virescence. By virescence in the narrower sense he understands those cases where an organ, losing its color, becomes green though retaining its original form. Under frondescence, on the other hand, he classes those cases where organs, while retaining their position, acquire the character of leaves. To the latter phenomenon,

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* This screenhouse, composed of a wooden frame, into which panels of fine wire screen are fitted every spring, and which possesses a glass roof, I use for the purpose of excluding insects from those of my plants which do not readily lend themselves to protection from insect visits by means of parchment paper bags or portable screen-cages. It is especially useful in the cross-fertilization of very small flowers, where the operation is liable to be long and tedious. It allows the potted plant to be elevated to a convenient height and eliminates all danger of insect visits during the operation.

† Engelmann, G. De Antholysi Prodromus. 32. Frankfurt a. M. 1832. Reprinted in "The Botanical Works of the late George Engelmann."

Morren,* who goes into details, applies the term phyllomorphy. But Penzig† does not draw so sharp a line of distinction. Ordinarily there is no need for this, since evidently numerous cases exist where the two phenomena grade into each other, as evinced by Penzig's phraseology. Besides, where virescence in the stricter sense affects the entire flower, the result, *i. e.*, the non-production of seed, is the same. This was the case in the virescence of *Lonicera Periclymenum* mentioned by Morren, something which I also have been able to constatate during 1904, 1905 and 1906 on plants of *L. sempervirens* cultivated in the Missouri Botanical Garden. But it is a very different matter where virescence affects but a single circle of floral envelopes. The other organs appear to be in no way changed. The fertility of the flower is not impaired. The abnormality is transmitted to the offspring.

It would appear then that in *Oxalis stricta viridiflora* we have a variety, at once constant from seed, which differs from the species in but one character. This character chiefly finds expression in (1) the color of the petal, due to the presence of chlorophyll granules, and (2) the texture of the petal, due to an increase in the number of layers of cells. Thus far this variety does not seem to have spread in the neighborhood of the type locality. But in the vicinity of Belleville, Ill., not far from St. Louis, my father, Dr. M. P. Hus, during August, 1907, found three plants of what appeared to be O. *stricta* with white petals and white and green petals.‡ A microscopical examination confirmed the opinion that but little, if any, chlorophyll would be found in the white parts. The yellow chromoplasts were not entirely absent from all cells, but present in so small number as to be ineffective. This plant also will be taken into cultivation. Crossing experiments undertaken this year will, during the next, undoubtedly yield interesting results.

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* Morren, Ch. Læs virescences distinctes des phyllomorphies et cas particulier d'une virescence de chèvrefeuille. (Bull. Acad. Roy. Belg. **17**[2] **:** 125. 1850).

† Penzig, O. Pflanzen-Teratologie. **1 :** xx. 1890.

‡ A white-flowered form of *O. violacea* is sometimes found.

EXPLANATION OF PLATES.

PLATE 10.—*Oxalis stricta viridiflora.* Cultivated plant, × ½.

PLATE 11.—*Oxalis stricta viridiflora.* Above, parts of the flower and fruit, × 2. First are shown five petals, then a fruit from which the petals have been removed, followed by a flower which contained a pod of about the size of the one below it. This pod was cut out near the point of attachment. The five petals and some of the sepals are shown. The next row shows six stages in the development of the fruit. The one on the right is almost mature, but the petals are still present. Below, a fruiting plant collected in the original locality, × 1.

OXALIS STRICTA VIRIDIFLORA.

OXALIS STRICTA VIRIDIFLORA.

EFFECT OF LIGHT UPON THE GERMINATION OF SPORES AND THE GAMETOPHYTE OF FERNS.

BY A. C. LIFE.

While germinating fern spores in 1905 at the Missouri Botanical Garden, for the purpose of producing material for a morphological study, it was noticed that different intensities of light had a decided effect upon germination. A perusal of the literature revealed conflicting results by different investigators. It was then thought worth while to verify the work, or at least attempt to clear up the discrepancies of the earlier investigators. Consequently, in the early part of 1906, experimentation was begun with different intensities of light.

Historical.

The earliest definite experimentation upon the effect of light upon fern spore germination was that of Borodin in 1868. He worked mainly with the spores of *Aspidium spinulosum* and *Aneimia phyllitidis*, and was not able to obtain germination in darkness. The exposure of some of the spores to light after they had been in the dark 18 days, was sufficient to bring about germination in 9 days after they were removed from darkness. He also experimented with spores of *Asplenium*, *Allosorus*, *Polypodium* and *Phegopteris*, and obtained no germination in the dark. Schmidt also was not able to secure germination of the spores of *Aspidium violascens* and *Aspidium filix mas* in the absence of light. His work was in 1870, two years later than that of Borodin.

Goeppert in 1869 germinated spores of *Osmunda* in darkness, while Kny in 1872 could not verify his results.

Schelting in 1875 reported germination of *Pteris aquilina*, *Aneimia phyllitidis*, and two species of *Aspidium* in darkness at a temperature higher than the ordinary room temperature. In 1878, in his experiments with *Scolopendrium*, Beck found that light of a certain intensity was necessary for the germination of the spores. The spores of *Equisetum*, with respect to

the effect of light upon their germination, were experimented with by Sadebeck. He reported that light is not necessary for their germination.

The germination of the spores of liverworts was worked upon in 1876 by Leitgeb. He found that they neither germinated in darkness nor very weak light. When germinated in light they formed a germ-tube which was slightly negatively geotropic.

More recently Forest Heald in 1898 carried out a valuable line of experimentation upon moss, fern, liverwort, and equisetum spores. He secured germination of moss spores in darkness by using either a sugar or a peptone solution as a culture medium. Fern spores, especially those of *Ceratopteris thalictroides* and *Alsophila Loddigesii*, were made to germinate at a temperature of 32° C. He was not able to cause liverwort spores to germinate in darkness in sugar solution at higher temperatures. He attributes his failure to the effect of bacteria which grew in his cultures. Equisetum spores germinated readily in ordinary media at ordinary temperature in the dark.

In 1901 Schulz obtained results that in some respects were contradictory to those of Heald. He does not regard the swelling of the moss spore in the sugar solution without light as normal germination. Spores were germinated in blue as well as yellow light, but required 30 days instead of 20 days, the time required in yellow light. No germination of fern spores in darkness at 30°-35°C was obtained, contradictory to the work of Heald. To determine this, he worked with spores of *Gymnogramme chrysophylla*, *Aneimia phyllitidis*, and *Alsophila australis*. However, he was able to germinate *Ceratopteris thalictroides* in 3 days in darkness at 30°-35°. This agreed with the work of Heald.

Treboux in 1905 verified the work of Heald in the germination of moss spores in sugar solution. He was also able to secure germination in inorganic solutions. Further, he found that the gemmae of *Marchantia* would grow into prothallia in both organic and inorganic solutions in the absence of light.

In 1907 Laage reported that a great many species of ferns

were able to germinate in darkness in both sugar solutions and inorganic solutions, especially Knop's solution. However, *Alsophila australis*, *Asplenium lucidum*, and *Polypodium aureum* could not be induced to germinate in darkness under any conditions. Laage further claimed that there was no new formation of chlorophyll in darkness.

The Ophioglossaceae are reported to germinate in darkness. Hofmeister found prothallia of *Botrychium lunaria* three inches beneath the surface. Arcangeli reports the germination of *Pilularia*, and Woronew the same for *Marsilia* in the absence of light. Each of these investigators of the water ferns claims there is new formation of chlorophyll in the absence of light, especially in the germination of the megaspore.

Much less work has been done upon the effect of light upon the prothallium and sex organs than has been done upon germination. In 1879 Prantl reported that strong light produced a growth of archegonia, of course on the shaded side of the prothallium, and that weak light tended to produce only antheridia. The effect of light upon the dorsiventrality of prothallia had been worked upon earlier by Prantl and others.

Methods.

The spores which were sown in the progress of this experimental work were almost all collected at the Missouri Botanical Garden, and sowed soon after collection. They were collected at any and all times of the year, and germinated almost as well in winter as at other seasons. The *Alsophila australis* spores germinated after a rest of about a year after collection. The spores of other ferns which were worked with, germinated well when sown as soon as they were thoroughly dry.

The spores were nearly all germinated in specially prepared boxes with sliding glass covers. These boxes were filled to a depth of about six inches with sterilized garden soil. The pots in which the spores were sown were imbedded in this soil, to a depth of about two-thirds of their height. To determine the best medium upon which to sow the spores, ex-

periments were made with sand, garden soil and leaf mold. From these experiments it was found that leaf mold was the best medium, of those experimented with, for the germination of the spores. In preparing the pots for sowing the spores, they were filled to a depth of about an inch and a half with either coarse cinders or broken pieces of pots. Upon this a layer of garden soil was placed which extended to within about an inch of the top of the pot. This soil layer was then covered with a layer of sifted leaf mold to within about a quarter of an inch of the top. The pots were then thoroughly sterilized in a Koch steam sterilizer. Just before sowing the spores the pots were completely saturated with sterilized water. After the spores had been sown, glass plates were placed over the pots and they were imbedded in the germination boxes. The pots were not watered directly, but the soil surrounding them was kept well moistened.

Two special germinating boxes were prepared; one for germination in strong light, and the other for germination in absence of light. The box for strong light had a glass front and cover, and was painted white on the inside. The box for germination in darkness was constructed so as to exclude light and at the same time to allow some access of air. This was accomplished by means of a closely fitting sliding cover which overhung the lower part of the box one end of which was perforated. A thermometer was placed in the cover of this box. Petri dishes were also used for germinating spores. Two or three thicknesses of filter paper were placed in each of them, and they were then filled about one-third full of 0.5% Knop's solution, and sterilized before the spores were sowed. These cultures, as well as some upon leaf mold, were kept in an incubator at a temperature of from 30° to 33° C. As a means of exposing the spores to one-sided illumination during germination, black paper was placed upon Petri dishes, leaving an opening on one side for the entrance of light.

The intensity of the light was determined by a light meter used for determining the time of exposure in photographic work. The time required for bright sunlight to change the sensitive paper to the standard tone was taken as the unit.

By the method used by Wiesner, other intensities of light were determined by a comparison of the time required to produce the normal tone with the time taken in bright sunlight. A number of observations were taken of each intensity of light and the intensities given in this paper are the averages of these observations. The intensities are those of sunlight or diffuse daylight, as artificial light was not used; in fact, natural conditions of light were more nearly simulated than can be done by artificial light.

Influence of Light of Different Intensities upon Germination.

Before giving the results of the experiments upon different intensities, the effect of entire absence of light will be given.

Spores of *Dicksonia apiifolia* upon leaf-mold were sowed February 3, 1906, and on February 3, 1907 were examined and found not to have begun germination. This culture was then exposed to light and division took place within about 8 days, and in about 20 days the surface was green with the young prothallia. Thus spores were able to germinate after having been in a moist dark chamber for an entire year. Another sowing of *D. apiifolia* started February 19, was transferred to light September 29, and germinated by October 10. A culture of *Alsophila pruinata* was sowed and transferred to light at the same time as the *Dicksonia*, and germinated by October 8. Sowings of *Aneimia phyllitidis* and *Gymnogramme calomelanos Mertensii* were kept in darkness 40 days without germination, while the control from the same groups of spores germinated in 10 days.

Sowings of *Asophila pruinata* and *Aneimia phyllitidis* were made upon leaf-mold and exposed to a temperature of 30°-33° C. in darkness during a period of 41 days for the *Alsophila* and 40 days for the *Aneimia*. Neither germinated in the absence of light even at the higher temperature. The *Alsophila* culture was transferred to light, and germinated in 11 days, while the control of the *Aneimia* germinated in about 10 days in light.

In 0.5% Knop's solution in darkness at 30°-33° C., a sowing of *Gymnogramme calomelanos Mertensii* germinated in 20

days. A sowing of the same species in leaf-mold at room temperature did not germinate in darkness in 40 days.

In very diffuse light of 0.002 intensity, the spore coats of *Alsophila pruinata* burst, but germination went no further during a period of six months. No change took place in *D. apiifolia* in the same time, and no germination began in either *Aneimia phyllitidis* or *Asplenium filix foemina* in three months.

To determine the effect of different light intensities upon length of time required for germination, *Alsophila pruinata*, *A. australis* and *Dicksonia apiifolia* spores were used in the experiments.

Cultures in leaf-mold, of *A. pruinata*, were placed in different intensities of light, and the time required for germination was noted. Temperature and moisture were made as nearly equal as possible in all the cultures. They were all in the same green-house, exposed to a temperature varying from 18° to 24° C. In light intensity of 0.15, first division, which is a definite point in germination and is used to designate germination in this paper, took place in 25 days.

In light intensity of 0.075, division or germination began in 12 days. In light of 0.02 intensity there was no germination in 25 days, in fact the spore coats were just bursting.

Two series of *Dicksonia apiifolia* were grown. The first was sowed on September 29, and examined on October 15, On this date the spore coats of those in light 0.15, had just begun to burst, while those in the weaker light of 0.075 intensity had begun to germinate.

The second series was sowed on November 24, and on December 15, after 11 days, the spores of the culture in light 0.075 had divided, and some of them were well along in germination. At the same time the spore coats of those in light 0.15 had just begun to burst. The spore coats of those in weaker light of intensity 0.02 did not burst until the fifteenth day, while those in light 0.075 germinated in 8 days.

A series of spores of *Alsophila australis* was sowed on September 27, and examined on October 24. The spores from light intensity 0.15 had germinated and formed young prothallia of from 2 to 3 cells. Those in light 0.09 had grown into prothallia of from 5 to 12 cells, and those in light of the

intensity 0.02 had divided and formed prothallia of from 2 to 5 cells. The difference in the effect of light of the intensity 0.15 and 0.09 was very marked on November 14, when the culture grown in the latter intensity was bright green, while the surface of the culture grown in the more intense light showed very little color.

From these experiments it is readily seen that these fern spores germinate most readily in a light intensity of from 0.075 to 0.09, and that both great and low intensities of light are not as favorable for germination as medium intensity. Of the fern spores used in this experimental work, none were able to germinate upon leaf-mold in absence of light, neither were they able to germinate in very weak light.

Alsophila pruinata and *Aneimia phyllitidis* could not be induced to germinate in leaf-mold in darkness at a temperature of 30°-33° C. This is contrary to the results of Heald, who germinated a species of *Alsophila* and other ferns, among them *Ceratopteris thalictroides*, at a temperature higher than the ordinary laboratory temperature.

Schulz was able to germinate *Ceratopteris thalictroides* in darkness at a higher temperature; but was not able to secure germination of the same species of *Alsophila* that Heald worked upon. Neither was he able to germinate any other species in darkness at a higher temperature. He thinks *Ceratopteris* is capable of germinating in darkness because it has a water habit, such as the Marsiliaceae, which germinate in darkness according to Arcangeli and Woronew.

Laage, in some recent work upon germination, claims higher temperatures have a retarding effect.

The germination of *Gymnogramme* in 0.5% Knop's solution is not exceptional, as Laage secured germination of a number of ferns in both organic and inorganic solutions in absence of light. In his valuable work he shows what strengths of various solutions are most favorable for germination in darkness. However he was not able to germinate *Alsophila australis*, *Asplenium lucidum*, and *Polypodium aureum* under any conditions in absence of light.

According to the results of several investigators, the stimulus to germination and to growth which in nature is given

by light may be given by either organic or inorganic solutions.

Examination of the chlorophyll content of the spores used in the experiments, was made with the result that all of them contained more or less chlorophyll. *Alsophila pruinata* spores have more chlorophyll than *Alsophila australis* and germinate much more readily.

Laage in his work with chemical solutions found that *Osmunda* spores germinate more readily than other spores, which no doubt is partially due to their having a larger chlorophyll content.

Some work has been done by Heim and Schulz upon the effect of different parts of the spectrum upon germination, but very little upon the effect of different intensities of white light.

Effect of Light of Different Intensities upon the Prothallia and Reproductive Organs.

First the effects of absence of light will be given. Prothallia of *Dicksonia apiifolia* that were grown in light favorable for the production of archegonia and which bore them abundantly, were placed in darkness and left there three months. Although they were covered with water, as were also the cultures in light, to insure the freeing of the sperms and the possibility of their reaching the archegonia, no sporophytes developed. Control cultures in light under other similar conditions bore sporophytes in abundance. At the end of the three months the prothallia were paler than when placed in darkness, but still contained abundant chlorophyll. Antheridia developed upon the upper surface near the margins of the prothallia. This production of antheridia in darkness is exceptional and, as far as my experiments were conducted, took place only in mature prothallia that were placed in darkness.

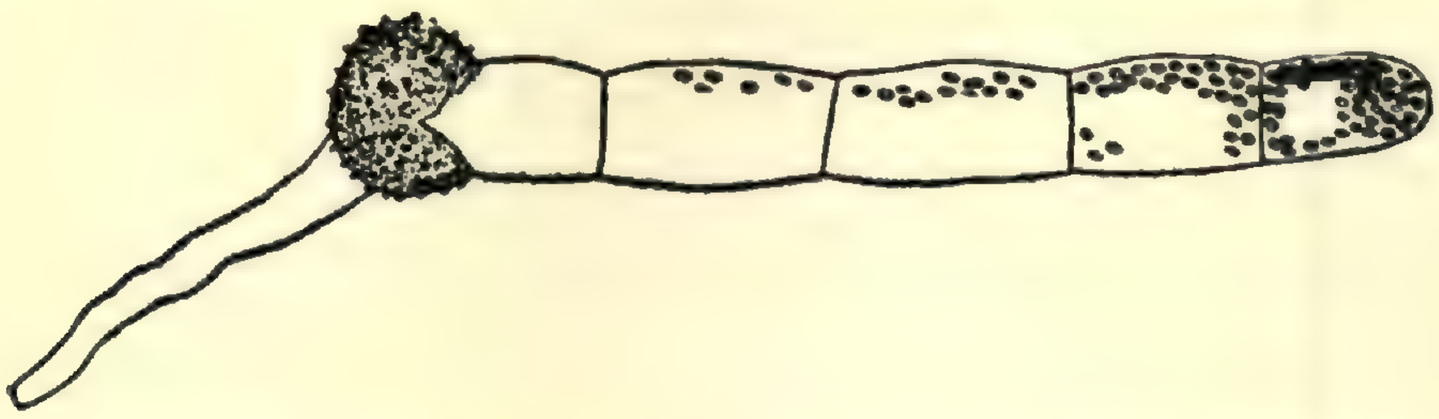
Spores of *Aneimia phyllitidis* and *Asplenium filix foemina* were first germinated in light and when the prothallia, in the two- or four-celled stage, were transferred to darkness, it was found that they had increased some in length, and that the cells were more elongated than when placed in darkness. The extremities of these tubular or filamentous prothallia

contained considerable chlorophyll, but the basal cells contained none, or only a trace. The starch had also disappeared from all the cells.

After germinating in light of considerable intensity, cultures of several kinds of ferns were transferred to light of an intensity of about 0.002, very diffuse light, when in the 2-4 celled stages.

Dicksonia apiifolia produced elongate prothallia some of which were from 2-4 cells in width near the tip. *Alsophila pruinata* grew out into tube-like forms. *Aneimia phyllitidis* grew into tube-like and more branching prothallia. The disappearance of the chlorophyll from the base and the grouping of it near the tips was very noticeable in the *Aneimia* cultures.

Cultures of *Asplenium filix foemina* did not elongate so much as the others, and all the cells contained abundant



1. GERM-TUBE OF ANEIMIA SHOWING CHLOROPHYLL CONTENT OF CELLS, × 100.

chlorophyll. None of these cultures produced antheridia in this intensity of light, although they remained from two to three months under this condition.

Cultures of the same species as mentioned above were germinated in light and then transferred to stronger light than that of the former experiments, of an intensity of 0.008. In this condition the cultures produced antheridia but no archegonia.

A specially abundant crop of antheridia was produced in a culture of *Alsophila pruinata*. This culture was first grown in weak light and while still yet having no antheridia was transferred to a position where the light was from above and of an intensity of .01. Within about a month antheridia de-

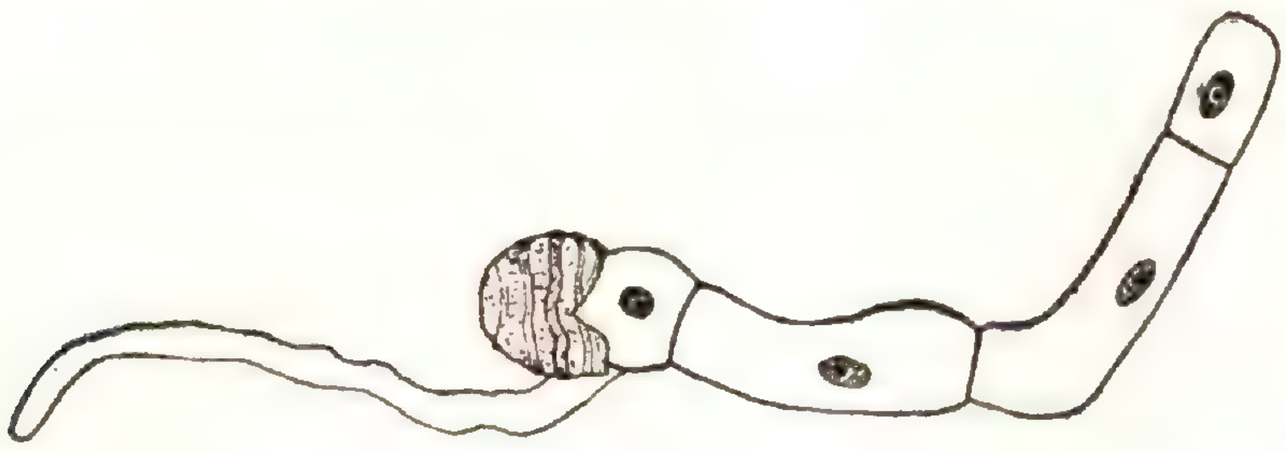
veloped abundantly over almost the entire under surface of the prothallia.

Prothallia of *A. pruinata* germinated and grown in light of an intensity of 0.3 had abundant archegonia but no antheridia. About 25 of these prothallia were sectioned and no antheridia were found upon any of them. Later on this culture was transferred to weaker light and antheridia developed. Some of these prothallia took such a position with reference to the light that they were about equally illuminated on both sides, with the result that archegonia were produced on both sides.

A noticeable effect of different intensities of light upon the form of the prothallium was observed especially in *Alsophila pruinata*. In very diffuse light of 0.002 intensity the growth was a somewhat branched filamentous form. In stronger light of 0.008 intensity, the prothallia grew out into ribbon-like forms and bore only antheridia. In these no trace of a meristematic cushion upon which archegonia develop, was to be found. In still stronger light the expanded heart-shaped prothallium was produced which bore both archegonia and antheridia. In more intense light of 0.3 intensity, archegonia but no antheridia were produced upon heart-shaped prothallia shorter than those in weaker light.

Cultures of *D. apiifolia*, *Asplenium filix foemina*, and *Aneimia phyllitidis* produced both archegonia and antheridia when grown in light varying from 0.03 to 0.3 intensity.

Cultures of *Aneimina phyllitidis* and *Gymnogramme calomelanos Mertensii* were exposed to light from one side only



2. GROWTH OF GYMNOGRAMME GERM-TUBE WITH LIGHT FROM ONE SIDE, AND THEN SHIFTED ABOUT 90°, × 100.

in Petri dishes containing 0.5% Knop's solution. Both of the cultures produced tubular prothallia that were positively

heliotropic By shifting the culture of *Gymnogramme* about 90°, a bending of the prothallia was observed in a direction toward the light, while the rhizoids turned from the light.

Some work upon the effect of different intensities of light upon the prothallia and reproductive organs was done by Prantl in 1879. He reported that in weak light only antheridia were developed upon the prothallia. His work was with *Aneimia phyllitidis, Polypodium vulgare, Osmunda regalis,* and *Aspidium filix mas.* However, he did not give the intensities of the light to which he subjected the prothallia.

Klebs' work in 1893 is verified in the main by my results. By weak light he obtained branching prothallia with adventitious growths and with *Pteris aquilina* he secured a thread-like growth, resembling that of *Trichomanes* normally. In strong light heart-shaped prothallia were produced which bore both archegonia and antheridia.

Furthur work along the line of my investigation is that of Heim. He experimented with strong and weak white light, as well as yellow, blue and violet rays of the spectrum. In strong light he grew heart-shaped prothallia that produced both archegonia and antheridia. He reports the best growth of prothallia in daylight reduced 20-25%. In weakened light, but he does not say how much, elongate prothallia were produced which bore both archegonia and antheridia. The cultures in yellow light grown by him produced long and narrow prothallia with antheridia but no archegonia.

The blue and violet rays of the spectrum were the same as the reduced light, slackening the growth and producing adventitious prothallia. His results are of interest because the yellow light had the same effect as white light of tolerably small intensity in producing only antheridia. Here I wish to say that my cultures producing antheridia remained so for about six months, with no sign of archegonia upon them.

The effect of nourishment upon the archegonia and antheridia was worked upon by Prantl in 1881 with the result that the archegonia could be suppressed by nourishment lacking in nitrogen.

This is interesting in that it shows that other factors than light may enter into the problem. It is very probable that

anything that lowers the vitality or interferes with the usual life processes may inhibit the production of the archegonia.

In some unpublished work by Shattuck at the University of Chicago, upon the Marsiliaceae, it has been found that light may inhibit the production of the megaspores.

Spores were exposed to light from one side only to see if they exhibited the polarity reported by Stahl for *Equisetum* spores, but they gave only negative results. These same cultures did show the marked heliotropism before mentioned. This heliotropism was observed some years ago by Sachs, Prantl, and others, and Wiesner (81) has worked out a theory for such heliotropism based mainly upon turgor. Leitgeb (76) reports positive heliotropism for liverwort prothallia.

To show that fern spores are capable of germinating independent of photo-synthesis, Schulz germinated spores in air free of carbon dioxide, in the presence of light. He claims in this germination the oil of the spore is converted into starch by the stimulus of light. We may infer, from the fact that a number of investigators have gotten starch formation in darkness by cultivating spores in both organic and inorganic solutions, that these solutions give a stimulus to the transformation of the substances in the spore to starch. Laage takes the position that there is no new formation of chlorophyll in germination in darkness. This is contrary to the results of Schelting upon germination of the spores of ferns, and to Bittner as well as Schimper upon the ferns in general. From the fact that *Equisetum* spores, which contain an abundance of chlorophyll, are able to germinate readily in darkness at ordinary temperatures as shown by Heald, and spores that have most chlorophyll form a young prothallium with more chlorophyll than those with less chlorophyll, the view of Laage is a very plausible one. It is noticeable that the chlorophyll in the spore has a different form of plastid from that of the young prothallium, the plastids of the spore being much smaller and sometimes apparently little more than granules.

SUMMARY.

1. Under ordinary conditions spores of Cyatheaceae and other ferns experimented with, do not germinate in darkness when sowed upon leaf-mold.

2. Higher temperature than ordinary room temperature was not sufficient to induce germination of *Alsophila pruinata* and *Aneimia phyllitidis* in darkness.

3. Germination was best in light of medium intensity, about 0.075 sunlight.

4. Intensity of light affects form of prothallia, weaker light producing filamentous or ribbon-like prothallia, while strong light produces heart-shaped prothallia in all except *Aneimia*, which has a lateral growing point.

5. Strong light of intensity of 0.3 causes production of archegonia only in *Alsophila pruinata*, while in other ferns worked with, archegonia and antheridia were produced.

6. Weak light inhibits the production of archegonia and favors the production of antheridia.

7. Young stages of the prothallia of *A. pruinata*, *Aneimia phyllitidis*, and *Gymnogramme* are strongly and positively heliotropic.

In conclusion I wish to express my thanks to Professor Wm. Trelease and Professor S. M. Coulter for valuable suggestions in the preparation of this paper.

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THE CABIN ON THE COMAL.

PLANTAE LINDHEIMERIANAE.

PART III.

BY J. W. BLANKINSHIP.

On the death of Dr. George Engelmann his entire herbarium was presented to the Missouri Botanical Garden by his son, Dr. George J. Engelmann, and became the nucleus of the herbarium of that institution. Among the duplicates that came with the Engelmann herbarium was a considerable number of Lindheimer's Texas plants, which were at first supposed to be the undistributed portion of the exsiccatae described in "Plantae Lindheimerianae," but later it was found that they were an undistributed collection made subsequent to the specimens described in that publication and represented the work of Mr. Lindheimer during the years 1849, 1850 and 1851. At the suggestion of the Director of the Garden, these collections have been carefully studied during the present year, and this paper prepared to complete the work of the first two parts of Plantae Lindheimerianae and render the data there contained more accessible to those concerned with the flora of Texas and regions adjacent, while the plants themselves have been labeled and laid out into sets for distribution to correspondents of the Botanical Garden. This final collection of Mr. Lindheimer proves to be of considerable importance, not only from its historical interest, but also from the fact that it contains a large number of the type collections, since described in various publications and many more from the type locality, made by the original discoverer of the species, while the great majority of the species are relatively rare in many of our herbaria, the older distributions having gone largely to Europe. The plants themselves are in a fairly good state of preservation, considering the lapse of more than half a century since their collection, the ravages of the usual herbarium pests and the accidents of transportation and storage during this time.

Mr. Lindheimer, it appears, began collecting and studying the flora of Texas immediately upon his arrival there in 1836, but it was not till about 1842, after the political conditions became more settled, that he collected in any quantity, and early in the following year Dr. George Engelmann suggested to Gray that they coöperate with Lindheimer by naming and distributing his collections of Texas plants, so as to enable him to devote his whole time to this work and thus advance the cause of science in a land then almost wholly unknown botanically. The outcome of this undertaking was the collection of four fascicles of plants bearing the numbers 1 to 754, and the publication of the first two parts of Plantae Lindheimerianae describing a part of them. Fascicle I contained 214 species collected in 1843; Fascicle II represented the 1844 collection with nos. 215-318; Fascicle III consisted of nos. 319-574 of 1845-6; and Fascicle IV, comprising nos. 575-754, was collected in 1847-8. The specimens of the collection of 1849-1851, here treated, were probably intended to form Fascicle V. It appears that the first two fascicles were issued in about 20 sets, only some 9 of which were at all full, while Fascicle IV contained about 40 sets.* The collection of 1849-1851 contains about 650 numbers and there

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* The following appear to have been subscribers for the whole or part of the first four fascicles of the "Flora Texana Exsiccata," as shown by Gray's unpublished letters to Engelmann:

Alexander, Dr.; England.
Bentham, George; England.
Boissier Herbarium; Geneva.
Braun, Alexander; Berlin.
British Museum; London.
Buckley, S. B.; Texas.
Carey, S. T.; New York.
Cleaveland, Prof. P.; Brunswick, Me.
Durand, Elias.
Engelmann, George; St. Louis, Mo.
Fielding, H. B.; England.
Gray, Asa; Cambridge, Mass.
Greene, B. D.; Boston.
Harvey, Prof.; Dublin.
Jardin des Plantes; Paris.
Kew Gardens; England.
Lamson, Prof.; Kingston, Canada.
Leman.
Lowell, John A.; Cambridge, Mass.
Oakes, William; Ipswich, Mass.
Olney, S. T.; Providence, R. I.
Saunders, William; England.
Shuttleworth, R. J.; England.
Smithsonian Institution, Washington.
Stevens.
Sullivant, Wm. L.; Columbus, O.
Thurber, George.
Torrey, John; New York.
Webb, Barker.

will be some 50 sets for distribution, of which about 35 are fairly full. This last collection of Mr. Lindheimer is therefore about as large as all the others together and duplicates a considerable number of their species. The more recent herbaria will consequently be fortunate in thus being able to secure representatives of this early Lindheimer set of exsiccatae.

It appears to have been the original plan of Engelmann and Gray to give a number to each different species collected, but this was abandoned largely in the later fascicles and, in the present paper, a number has been assigned to each separate collection, as far as possible, thus ensuring a single locality and date for each, while the whole has been printed on the label itself, instead of merely the number, as was the case with Fascicles I-IV, where the information was supposed to be supplied by the publication of Plantae Lindheimerianae and often several different collections of a species were issued under a single number. Unfortunately this publication was left incomplete at the end of the Compositae (Bentham & Hooker sequence) for Fascicles III and IV, so that there have been no data given for numbers 449-574 (Fasc. III) and 652-754 (Fasc. IV), as found in various herbaria, and these will be supplied in the present paper, as far as the numbered specimens in the Engelmann herbarium permit. Unfortunately the existence of these numbers beyond 651 of the Plantae Lindheimerianae was not discovered till the printing of the labels of the 1849-1851 collection was so far advanced as to make renumbering impracticable, so that the numbers 652-754 are duplicated in Fascicles IV and V, but this need cause no confusion, as the dates and different form of label will readily distinguish each in herbaria, while the difference in the orders covered (Lobeliaceae-Marsiliaceae of Fasc. IV and Ranunculaceae-Leguminosae of Fasc. V,—B. & H. sequence) will enable the two to be distinguished even in publication.

A certain confusion has also arisen through authors quoting not only the exsiccatae numbers but also Lindheimer's collection numbers, when these happened to be on specimens examined in the Engelmann herbarium, or occasionally found

elsewhere. Lindheimer gave a number to each collection in the field, usually with more or less data in German as to habitat, locality, date, etc., his numbers following in order of collection. Engelmann then arranged the collections by orders and species after the Bentham and Hooker sequence, and gave independent numbers to the exsiccatae, following this sequence. However, a large number of Lindheimer's collections were never made in quantity, hence were never numbered for the exsiccatae and have only his own collection label in the Engelmann herbarium, and this must be remembered in quoting Lindheimer specimens, only the Engelmann label being printed. Throughout the present paper both numbers have been given, so as to enable the two to be identified, if needful, Lindheimer's collection number being preceded by "L."

The purpose of the present paper is not only to give a list of the species of this last Lindheimer collection of 1849-1851, preliminary to their distribution, but also to enumerate the species of the missing numbers of parts I and II of Plantae Lindheimerianae, as far as such can be found, and to give an index to the whole, as an aid to other botanists interested in the flora of Texas. There will be added a brief account of the pioneer-botanist-editor, Lindheimer himself, the importance and magnitude of whose work has scarcely been appreciated, and also a general bibliography of Texas botany.

Considerable of the work of classification and determination of the collections treated in this paper was done by Prof. A. S. Hitchcock some 15 years ago, and many of the determinations of Fascicles III and IV are by Engelmann and Gray, while I am indebted to Professor Trelease for advice and assistance in the preparation and arrangement of the work.

Much of the data concerning the life and work of Mr. Lindheimer has been supplied by his son, Mr. M. E. Lindheimer, of Austin, Texas, and his daughters, Mrs. Sida Peipers, of St. Louis, and Mrs. Anna Simon, of New Braunfels, Texas, without whose assistance many facts would have escaped my knowledge.

LINDHEIMER, THE BOTANIST-EDITOR.

"Unsere Handlungen werden jedoch nicht blos von einfachen Gedanken und Willensbeschlüssen geleitet. Der Zufall, oder vielmehr die Macht der äusseren Ereignisse und gar mannichfaltige Nebengedanken haben ebenfalls einen grossen Einfluss auf unsere Handlungen."—Lindheimer.*

Though the name of Lindheimer is well known in the botanical and German editorial world, his actual personality and the events of his adventurous life are largely a matter of tradition. Special pains have therefore been taken to investigate his career and the influences determining its chief events and to present this modest, studious, Nature-loving editor and philosopher, as he appeared to those around him.

Ferdinand Jacob Lindheimer was born in Frankfort-on-the-Main, May 21, 1801, and died at New Braunfels, Texas, Dec. 2, 1879. His father, Johann Hartmann Lindheimer, was a prosperous merchant of Frankfort, but died when his youngest son, Ferdinand, was yet a child. He was also related to the poet Goethe, whose maternal grandmother was the daughter of Attorney Lindheimer of the Imperial Chamber,† the ancestor of both, while the family itself is said to be derived from that of von Lindheim, one of its members having contracted a morganatic marriage and his descendants adopting the name Lindheimer.

The youth Ferdinand was given the best education obtainable, attending a preparatory school in Berlin and finishing his education at Wiesbaden and Bonn, taking his degree at the latter university in 1827, after which he accepted a position in the Bunsen Institute (Erziehungsanstalt) in his native city and taught there till 1833, when it was closed by the government and both he and George Bunsen were compelled to emigrate, after the failure of the political conspiracy of April 3 of that year, in which they appear to have been implicated.‡

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* Aufsätze und Abhandlungen. p. 136.

† Life of Goethe by A. Bielschowsky, trans. by W. A. Cooper. p. 10. New York. 1905.

‡ This particular school of Bunsen was noted for its political activity, no less than six or its teachers being condemned between 1826 and 1833. Allgemeine Deutsche Biographie. **18**: 697. Leipzig. 1883.

Apparently young Lindheimer soon after closed out his business affairs, and, taking his patrimony, sailed for America early in the spring of 1834. He landed at New York,* took the steamer to Troy, went by way of the Erie Canal to Buffalo, across the lake by steamer and down the Ohio Canal from Cleveland to Portsmouth. From here a river steamer carried him down the Ohio and up the Mississippi to St. Louis, from which he went to the German settlement at Belleville, Illinois, where the Engelmanns, Hilgards, Koerner, and many others of his friends and fellow townsmen had entered farms and established homes. He gives an account of his life there himself,† a fair sample of his general style of composition:

"In a forest in St. Clair County in the State of Illinois, stood an abandoned log-house, which eight young men, mostly newcomers, had chosen for their provisional dwelling. Not far distant from it was the hospitable farm of Forestmaster E., who had arrived a short time before from Rhenish Bavaria with a numerous family. The eight young men shared the living expenses with them. I am convinced that each of the eight will still recall the pleasure of the moment when the tone of the ox-horn sounded through the forest, calling them to dinner with that kind family, which, like most families, consisted not wholly of male companions.

"A great, carefully-planned drive-hunt, in which few wild animals were shot, moderately productive hunting for prairie-hens, and from time to time a rousing banquet, to which the neighbors were invited, shortened our time for us in a delightful manner.

"Though this aimless and thoughtless life was for a time pleasant for all of us, yet it was not for the *far niente* and the 'aus der Tasche zehren nicht der Zweck,' for which we had come to America. The forest and the prairie had already put on their pale autumnal mantle and a single 'norther' betokened the coming winter. The roof of our old log-cabin was so open that we could make astronomical observations from our beds, and the great chimney, in the last cold winter,

* Trans. Ill. State Hist. Soc. for 1894. pp. 289–292.

† Aufsätze und Abhandlungen. pp. 78, 79.

was so little able to warm the room that a certain doctor, who daily jotted down his notes, was compelled to use two pens, so that, by warming one after another, the ink would not freeze while writing. Who then can blame that, with such an outlook upon a North American winter, a *horror frigidus* overcame us and an irresistible desire for the South overmastered us?

"Yet once more we held a great 'Commers,' for which at this time (1834), the material had to be hauled from St. Louis, a day's journey away. Out of the unhinged doors of our great log-house a long table was made and in the evening the courtyard was filled with the saddled horses of our guests, so that it appeared as if a squadron of cavalry had entered and was seated around our long table in a joyful banquet.

"A few days later, six of the company, who were the forerunners of a southern emigration, took passage on a steamboat down the Mississippi with the intention of making an expedition on foot through Texas and Mexico."

During October the travelers lingered in New Orleans trying to find some way to get to Texas, which at this time was a terra incognita, the borderland between two hostile civilizations and ravaged alternately by bandits and Indians, and not even a map of the country could be found. Three of their number became discouraged and returned to St. Louis, and so the trip overland with packhorses to the City of Mexico was reluctantly abandoned. While here, one Baron von Seefeld endeavored to enlist them in a filibustering expedition to Mexico in an attempt to restore Bustamente to the Presidency, and another proposed that they accompany a vessel outfitting to search for the hidden treasure of the pirate Lafitte—another name for a marauding voyage against Mexican commerce. Finally they secured passage on a coasting schooner bound for Vera Cruz and soon found themselves in the tierra caliente of the tropics with the snow-clad Orizaba looming in the distance.

They waited here for a few days till a pack-train set out for the interior and accompanied it to the new German settlement at Cordoba. Here Lindheimer and Otto Friederich built themselves a cabin on a spur of Mt. Orizaba and made

collections in Natural History, particularly of insects, which later were sent back to Germany and acquired some note. After a time, however, the brothers, Otto and Eduard Friederich, purchased plantations, while Lindheimer managed a distillery on the sugar-plantation of Sartorius and Lavater, but after about a month a chance fire destroyed the canefields, and the works in consequence had to shut down. Lindheimer then formed a close friendship with a Mr. Gründler, who had a coffee plantation not far distant, and the two lived pleasantly for some time in their bachelor quarters on the estate.

It was about this time that the Texas uprising came and the Mexican papers were filled with bombastic articles against the Americans and the short work Santa Ana, "the Napoleon of the West," would make of them, when once he should get his army there. Lindheimer was already disgusted with the unsettled conditions of Mexico and the consequent insecurity of life and property, and convinced of the inherent incapacity of the Latin races to develop a strong and lasting civilization, while his Teutonic blood drew him to his cousins of the North, so after some sixteen months in Mexico, though several good positions were offered him there, he again set out for Vera Cruz and took the first vessel for New Orleans, after refusing a commission in the artillery in the Mexican Army of Invasion, offered by his friend, Colonel Holzinger.

So crude was the knowledge of the sailing masters of those days that this particular ship was wrecked off Mobile, Alabama, while the captain confidently believed he was beating off Matamoros, and Lindheimer was compelled to swim to land. Arriving at Mobile, he enlisted at once in a company of volunteers forming to aid the Texas revolutionists. This company was composed mostly of Irishmen under command of Captain Robertson, and on its arrival in Texas was stationed on Galveston Island, as a kind of coast defense in case Mexico should undertake to land troops at that point. This company was ordered by General Houston to join him, when he was concentrating his army for the battle of San Jacinto, but the battle was begun earlier than was expected and it did not reach him till the day after the battle, April 22, 1836.

After the army was disbanded, Lindheimer seems* to have come north to St. Louis and spent the summer of 1839 and probably the following winter here, but the climate was too severe for his lungs and again he took up his residence in the new republic of Texas. He located near Houston and engaged in truck-farming (1840-1843), but the land proved poor and the business unprofitable, so, urged by his friend, Dr. George Engelmann of St. Louis, he decided to give up this work and devote himself to that of collecting the largely unknown flora of Texas and depend upon the sale of his specimens for a living.

He had always been fond of botany and devoted much time to his favorite study while in the university with Engelmann and other botanists. He collected largely on his trip to Mexico and continued his botanical work even during the excitement of the Texas revolution, as many specimens in the Engelmann herbarium will attest, so that now, when in doubt as to his vocation in life, he naturally turned to that which he liked best, as long as it should afford him a means of livelihood. Moreover, the region in which he was situated was largely unknown botanically, only a few collectors† having previously visited it and the results of their work not having been published. The scattering collections already sent to Engelmann showed clearly the need of a scientific investigation of the plants of this borderland between the American and Mexican floras, and he urged Dr. Gray, who was then just establishing the Botanical Garden at Cambridge, to join with him and Lindheimer in the exploitation of this unique flora. Accordingly advertisements were inserted in several botanical journals, and in the spring of 1843 Lindheimer began collecting plants in quantity for distribution.

The first year he was not very successful, owing to various misfortunes, and a part of the collection of 1844 was lost in transmission, but the collections of 1843 and 1844, containing 318 numbers, were distributed as planned and their descrip-

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* A number of specimens in the Engelmann herbarium are labeled "St. Louis. 1839. Lindheimer," while similarly we find he was at San Felipe, Texas in March and New Orleans in April of that year on his way up.

† Berlandier, Drummond, Riddell and Leavenworth.

tion was issued by Engelmann and Gray as Plantae Lindheimerianae,* Part I, in 1845, while the collections of 1845 to 1848 were in part described in 1850 as Part II of the same. The collaboration of Engelmann and Gray in this publication led to a life-long friendship between them and proved of the greatest advantage to both in the prosecution of their scientific work. Gray with his larger herbarium and library did many of the critical determinations for Engelmann, while the latter kept more in touch with the various exploring expeditions, which made St. Louis their outfitting point, and supplied many of the field botanists to accompany them, and his critical studies in some of the most difficult genera are still regarded as classics in botany. Indeed the influence of Engelmann in the study of the flora of the Middle West is marked and the great work done in America by the German botanists of the last century deserves more than passing notice.

No one can do much in systematic botany in America without soon becoming acquainted with the names of Engelmann, Lindheimer, Geyer, Fendler, Wislizenus, Gattinger, Hilgard, Lüders, Riehl, Rugel, Eggert and a host of others of German origin. Many of these, like Engelmann and Lindheimer, were trained in the German universities and came to America to secure the freedom denied them in their native land. Others, as Maximilian and Roemer, simply made scientific expeditions into unexplored regions of the United States and published the results of their work on their return to Germany, while many others devoted their spare moments to botany through mere love of Nature, without intention of publication or hope of reward, and it was these that turned to Engelmann for encouragement and assistance in their work. Geyer, Fendler and Lindheimer did practically all their work in cooperation with Engelmann, while many other botanists of German descent looked to him for assistance in their botanical

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* Plantae Lindheimerianae, Part I, was issued about Sept. 23, 1845 and Part II about May 27, 1850; as shown by Gray's unpublished letters to Engelmann: the names given in part I therefore antedate those of Scheele in vols. 21 and 22 of Linnaea and in Part II all those of Scheele subsequently published.

difficulties, and the accumulated labors of these collectors and students have made known to the world a great part, probably the greater part, of the native flora of the western United States.

The half-century succeeding the Napoleonic wars was a period of great unrest in Germany. Napoleon's policy had tended to break down the smaller German principalities and to arouse a feeling of resistance and unity among the various political groups speaking the German tongue, while the success of the French people in their several popular insurrections inspired their neighbors also with the hope of freedom. This desire for political rights and national unity led to the uprising of 1830 and the revolution of 1848, and finally resulted in giving the Germans a constitution and a united Fatherland. Yet, while this struggle was going on, there was a large and continuous stream of German emigration, greatly increased after each political disturbance. America received the greater part of these exiles, who settled chiefly about Milwaukee, St. Louis and Cincinnati.

This constant absorption by the Anglo-Saxon race of the strongest and most independent of the German blood finally became a source of solicitude to those who had the good of the Fatherland at heart and led in 1844 to the formation of a company of twenty-five German princes and nobles entitled the "Verein zum Schutze deutscher Auswanderer in Texas," usually called the Adelsverein or Mainz Company, which had for its object "To conduct the German emigration, as far as possible, to a single favorable selected point, to assist the emigrant upon his distant journey and in his new home and to work for strength therein, that a new home shall be secured for them beyond the sea;"* the evident intention being to Germanize Texas, then a republic with a small cosmopolitan population, and to keep the emigrants in touch with the Fatherland.

Prince Carl zu Solms-Braunfels, whose speeches and writ-

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* Roemer, "Texas." 20–41.—Penniger's "Geschichte des Adelsverein."—Tex. State Hist. Assoc. Quarterly. **3:** 33–40.—Kuno Damian von Schutz, "Texas Rathgeber für Auswanderer nach diesem Lande." Wiesbaden. 1846. pp. 135–232.—Solms-Braunfels, "Texas." Frankfort. 1846.

ings had aroused great enthusiasm for this scheme of colonization, was appointed General Commissioner for the Company and came to Texas in May, 1844, to prepare the way for the expected immigration. He purchased a grant of land in what is now Comal County, and when the first instalment of five ships and 150 families arrived at Galveston in November, 1844, he conducted them to Port Lavaca and then up the Guadalupe to its junction with Comal Creek, where he founded the city of Neu Braunfels, named for his old German home, and erected his "castle" upon an eminence near by, after the old German custom.

Mr. Lindheimer, learning of this effort at German colonization, met the immigrants on their arrival on the coast, was gladly received into the company on account of his local knowledge, and assigned a share in the land-allotment at New Braunfels, where he thereafter made his home. There is a good description of Lindheimer at this time in Roemer's "Texas" (p. 133):

"In the first days of my sojourn in New Braunfels I formed an acquaintance, which was highly prized and very agreeable during the whole time I remained there, and to which I now look back with special pleasure.

"At the end of the village and at some distance from the last houses stood, half-hidden amid a clump of elms and oaks and hard by the brink of Comal Creek, a cabin or small house, which, with its enclosed garden in front, afforded by its appearance and position a true picture of the idyl. As I for the first time approached this simple, rustic habitation, I beheld before the entrance of the cottage a man busily engaged in splitting wood and apparently not unaccustomed to this labor. So far as the thick black beard, which covered his whole face, permitted it to be seen, he appeared to be a man at the beginning of the 40's. He wore a blue blouse open in front, yellow leather breeches and coarse shoes, such as are customary with farmers in this country. Beside him lay two beautiful brown-spotted bird dogs and fastened to one of the neighboring trees was a dark-colored pony.

"According to the description, the man could only be the one for whom I sought and who answered me in the language

of a cultured man, though in a mild, almost shy-sounding voice, which ill accorded with his rough exterior, and whose answer to my direct question, confirmed my supposition. It was the botanist, Mr. Ferdinand Lindheimer from Frankfort-on-the-Main. Residing in Texas for a considerable time he had by several years' zealous plant-collecting acquired a permanent scientific reputation, as regards the botanical knowledge of Texas, which had before been almost totally unknown and had been visited transiently but once before by an English botanist named Drummond.

"After Lindheimer had received at the German schools and universities the best available scientific education and special training in the ancient classics, he taught for a time in one of the higher educational institutions, but his dissatisfaction with the political condition of his native land for more than a decade and perhaps also his thirst for adventure drove him beyond the sea. He went first with several congenial companions to Mexico and lived there for some time in the neighborhood of the charmingly situated Jalapa upon the produce of a pine-apple and banana plantation, and went later to Texas, in order to take part as a volunteer in the latter part of the Texas war for independence against Mexico.

"After the close of this war he endeavored to live for some time as a farmer and to improve a farm, but this manner of life also did not appeal to him, and he decided, particularly at the urging of a friend in St. Louis, to gratify his inclination from earliest youth, a cherished delight for botany, and at the same time make it a means of livelihood. He bought a two-wheeled covered cart with a horse, loaded it with a pack of pressing-paper and a supply of the most indispensable provisions, namely, flour, coffee and salt, and then set forth into the wilderness, armed with his rifle and with no other companion than his two hunting dogs, while he occupied himself with collecting and pressing plants and depended for his subsistence mainly upon the results of the chase, often passing whole months at a time without seeing a human being.

"When, then, in the late fall of 1844, the first large train of German immigrants under the leadership of Prince Solms arrived in Texas, Lindheimer joined them and was joyfully

received by the new comers, as a man with knowledge and experience of the country. He went with them to Comal Creek and when the city of Neu Braunfels was founded here in the spring of the following year, renouncing all other claims to land, he asked of Prince Solms for himself a spot of ground, small and worthless, but charmingly situated upon the steep bank of the incomparably beautiful Comal Creek, and here he built a little cabin and began now, with more leisure and convenience than he had ever before enjoyed in Texas, to explore systematically the rich and, for the most part, still unknown flora of the country around him.

"He was soon convinced, however, that he could not collect plants effectively and at the same time conduct his domestic affairs properly, however simple they might be. If, for example, he returned home of an evening all tired out with plant-collecting, he still found it necessary to prepare his own supper; if he tore his clothing among the thick bushes of the river forest, he himself must take up his needle and thread and repair the damage; if he needed a clean shirt, he had to go down to the river and wash it. He chose the right means to thoroughly remove all these inconveniences of his lonely bachelorhood. He sought for himself a consort and found her in a daughter of one of the recently arrived immigrants. The cabin on the Comal* has proven sufficiently large for two and everything goes on therein according to wish, though in primitive simplicity."

This account by Roemer, though inaccurate in some particulars, represents fairly well the difficulties under which Lindheimer labored at this time in the midst of his botanical work. He was married to Eleonore Reinarz of Aachen at San Antonio in 1846, and two sons and two daughters resulted from this union, all of whom are still alive.

Lindheimer and Roemer made many botanical excursions together during 1846 and the value of the latter's collections

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* Though a new and more commodious home was later erected beside the "cabin on the Comal" to meet the exigencies of an increasing family, this little log hut of pioneer days long remained as the oldest building in New Braunfels. The accompanying picture is from an aquarelle by Mr. Henry E. Peipers, a son-in-law of Lindheimer; copied by permission.

is largely due to Lindheimer's aid in the work. At the end of the season they appear to have exchanged a set of the collections made by each during the year, and Roemer, on his return to Germany, placed Lindheimer's with his own botanical specimens in the hands of Adolph Scheele, Pastor at Heersum near Hildesheim, who prepared a list of the species for Roemer's "Texas," and published the descriptions in Linnaea from 1848 to 1852 in his "Beiträge zur Flor von Texas." Not only did he publish the "new species" of Roemer's collecting, but also those found among Lindheimer's duplicates,* though he knew that Engelmann and Gray had already undertaken to describe these collections in their Plantae Lindheimerianae, and so industriously did he continue his work that he soon completely outdistanced his American competitors and left little for them to describe. This may have had something to do with the discontinuance of the Plantae Lindheimerianae, but not the slightest blame can be attached to Lindheimer, for he doubtless had no idea that any publication on his own collection was intended at the time the exchange was made. Nor was this the chief cause of the discontinuance of Engelmann and Gray's publication, for not only was this left unfinished at the end of the Compositae, but also all other lists then in course of publication by Gray, as the Plantae Wrightianae, Plantae Fendlerianae and Plantae Novae Thurberianae,—all crowded out by the pressure of more urgent work and publication, and never completed.

In 1846 the tide of German immigration turned northwestward to the Piedernales (or Padernales) River, where Friederichsburg was founded in what is now Gillespie County, and Lindheimer accompanied a train of settlers to this point early in 1847 and collected in this vicinity till September, when he pushed still farther north into the Indian country along with the Darmstaedter Kolonie,† the so-called "communistic colony of Bettina," which occupied lands between the Llano

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* Of the species from Texas described as new by Scheele, 73 were collected by Lindheimer and 66 by Roemer.

† Tex. State Hist. Assoc. Quarterly. **3 :** 33–40.

and San Saba Rivers, recently purchased of the Indians. This particular colony was composed of members of a higher class of intelligence and education than the average and afforded congenial companionship for the naturalist Lindheimer. He collected in this region till the fall of 1848, when the inroads of the Indians and the dissensions of the colonists caused the disruption of the society, and he returned to Comanche Spring, near San Antonio, where his friend, von Meusebach, had located a farm, and here he pursued his botanical work during the season of 1849.

Lindheimer himself was perfectly fearless of danger in his wide botanical excursions and his immunity from the Indians is largely due to that fact, though he appears to have been held by them in extreme reverence as a "medicine man," who wandered aimlessly about securing herbs for his decoctions and incantations, and many are the stories told of his adventures with them during these troublous times.* He returned to New Braunfels in the fall of 1849 and his work during the next two years was almost wholly in that vicinity. The collections of these last three years (1849-1851), which have never been distributed or described, are the subject of this paper. After this time Lindheimer never collected plants in quantity and only indulged in his love for botany as a recreation and to build up his own herbarium.

The German colonization society of Mainz practically ceased operations upon the admission of Texas as one of the states of the Union, and the attempt to found a semi-feudal principality in America failed, as all other such attempts had failed before, but it resulted in giving to Texas a large and industrious German population, which continued to spread and prosper till the need of a newspaper in their own mother-tongue became a necessity and the inhabitants of New Braunfels proposed a subscription to defray the expenses of securing a press and printing materials to establish one. Early in 1852 a mass-meeting of the citizens was held to elect the editor and publisher of the new German organ, and three candidates

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* See "Ein Verbrechen der texanischen Regierung, mit einem Anhang über die heistigen Indianer" in Lindheimer's "Aufsätze und Abhandlungen." pp. 63–78.

were proposed. Mr. Lindheimer was elected unanimously to this position and assumed with it the obligation of "standing security for the total cost, outlay, etc." of the paper. About two-thirds of the amount required was subscribed and he contributed the balance, so that the first number of the Neu Braunfelser Zeitung appeared in November of that year —the first German paper in Texas worthy of the name. After the beginning of the publication of the Zeitung, many of those who had contributed to its purchase desired that Mr. Lindheimer return the amount of their subscriptions in printing, advertisements and subscription to the paper or in cash, which was done, and the paper became his personal property. For twenty years he was editor and publisher of this paper, and only the infirmities of age compelled him to lay aside his duties. The Neu Braunfelser Zeitung was nominally Democratic, but was really intended and actually conducted impartially in the interests of the whole people and the editor was ever fearless in guarding them against private interest and political graft, always, however, leaving his columns open for the expression of the views of his opponents. With his customary modesty he never republished any of the praise received from out-of-town newspapers and was able to say on his retirement that he had never spoken against his convictions in his editorial management. His work as editor "yielded him but little pleasure and many annoyances, but, as in other things, here too the work itself was pleasure enough for him. The contents of the paper were frequently above the heads of the majority of his readers, but he did not write to suit the masses, but to uplift them, and thus the first 18 volumes of the Neu Braunfelser Zeitung offer, even at the present day, a rich treasure of instructive reading to the educated man."

In addition to his work as editor, during his later life Mr. Lindheimer assumed many public duties. He conducted a private free school for advanced pupils. He served as Superintendent of Public Instruction in his county for several terms and was the first Justice of the Peace of New Braunfels, till increasing age forced him to rest from his labors.

His botanical work can be best appreciated by remember-

ing the difficulties and dangers, the poverty and hardships under which his collections were made. He discovered and made known to the scientific world an enormous number of new species of plants from central Texas and many of these will ever bear his name. The beautiful *Lindheimera texana* is already not infrequent in ornamental cultivation and links his name with the country of his adoption, while many plants grown from seeds of his collection are found in the Missouri Botanical Garden at St. Louis, in the Botanical Garden at Cambridge, Mass., and elsewhere. His private herbarium at his death came into the hands of Prof. Emil Dapprich of Milwaukee, Wisconsin, and was on exhibition at the World's Fair at Paris. On Dapprich's death in 1903 it came into the possession of the German-English Academy of Milwaukee, where I understand it still remains.

Mr. Lindheimer was a careful observer and a patient collector, and the notes accompanying his collections add greatly to their value. The specimens of his last collection (1849-1851) will go to many herbaria in America and abroad and well exhibit the care and faithfulness of his work. It is to be regretted that time dealt not more leniently with them. A number of his new species he himself described and named, but many of the names he suggested were found preoccupied and others given.

Unfortunately many of Mr. Lindheimer's most valuable papers were published only in the Neu Braunfelser Zeitung and the New York Staats-Zeitung, and are all inaccessible to readers except in the German tongue. A number of his principal scientific, philosophical and historical essays collected from these papers have been republished in Germany under the title: "Aufsätze und Abhandlungen von Ferdinand Lindheimer in Texas,"* but the greater part are unknown and inaccessible to the general reader. In the "Aufsätze," his simple, direct, philosophical style is always interesting

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* A volume of 176 pages published anonymously by one of his former pupils, Dr. Gustav Passavant, at Frankfort a. M. in 1879, the year of Mr. Lindheimer's death. See the "Allgemeine Deutsche Biographie." **18**: 697. Leipzig. 1883.

and his meaning clear, quite different from the usual complicated, involved German sentence.

Mr. Lindheimer was a man of medium height, with blue eyes and black hair and beard, which in age became snowy white. He possessed a strong, active body, which he had developed in youth in the "Turnverein," and retained much of his bodily vigor in his old age. He was quiet and deliberate in manner, temperate and regular in his habits and a good conversationalist, though loath to boast about himself or much discuss his past history. He never became excited or used strong language. A "freethinker" in his opinions, yet he counted many priests and pastors among his best friends and never antagonized religious institutions. He did not believe in slavery, but espoused warmly the Southern cause at the outbreak of the Civil War.

There is much in this quiet, modest, unassuming man and his unselfish devotion to duty, that resembles his compatriot, General Houston. But, while the talents of the latter led him to war and political strife, Lindheimer turned to books and the beauties of Nature. Both were friends of the Indian, and indifferent to the accumulation of property, while they never allowed their own interests to come in conflict with the public weal. He ever loved freedom and independence, the simple life and intellectual enjoyment, and the reward for his labors was the esteem of his fellow-men. May Germany give us many such of Nature's noblemen!

NUMBERS OF FASCICLES III AND IV NOT PREVIOUSLY ENUMERATED.

As the "Plantae Lindheimerianae" was left unfinished at the end of the Compositae (Bentham and Hooker sequence) for the last two fascicles, it results that the numbers 449-574 and 652-754, which were distributed without names, localities and dates, yet remain in herbaria without such data, so that, as these fascicles contain many type collections, particularly of Scheele, I will endeavor to supply this information as far as the specimens can be found in the Engelmann herbarium at the Missouri Botanical Garden, and thus round out the work of the previous publication. In many cases the same number was issued in both fascicles III and IV, the latter, for 1847-8, have the (IV) affixed in the following enumeration. A few numbers enclosed in brackets are taken from Gray's list, but are not found in the Engelmann herbarium.

FASCICLE III. 1845-6.

449. LOBELIA SPLENDENS Willd. L. 342. New Braunfels. Aug. 1846.—Aug. Sept. 1845.—Piedernales. 1847. (IV).

450. SPECULARIA COLORADOENSIS (Buckley) Small. L. 65. New Braunfels. May 1846.—Apr. 1848 (IV). Type collection of *S. Lindheimeri* Vatké; Linn. **38**: 713. *Campanula coloradoense* Buckl. Proc. Acad. Phil. 1861: 460.

451. DIOSPYROS TEXANA Scheele. L. 126. New Braunfels. April 1846.

The type collection; Linn. **22**: 145.

452. DIOSPYROS TEXANA Scheele. (New Braunfels. May 1846).

453. DIOSPYROS TEXANA Scheele. L. 270. Colorado River 1845.—L. 126. (New Braunfels). June 1846.

454. MENODORA HETEROPHYLLA Moricand. L. 383b. Guadalupe River. Feb. 1845.—L. 218. 15 mi. W. of New Braunfels. Oct. 1846.—"On the Cibolo on

arid soil." July 1847 (IV).—Llano. Oct. 1847 (IV).

L. 218 is the type collection of *Bolivaria Grisebachii* Scheele. Linn. **25 :** 254.

455. MENODORA HETEROPHYLLA Moricand. L. 383a. Agua Dulce, Matagorda Bay. Feb. 1845.

456. ASCLEPIAS LINEARIS Scheele. L. 348. New Braunfels. Aug. 1846. The type collection; Linn. **21 :** 758.

457. ACERATES VIRIDIFLORA Eaton. ?L. 343. New Braunfels. July-Sept. 1846.

458. ASCLEPIODORA VIRIDIS Gray. L. 272. Guadalupe River. July 1845.—L. 345. New Braunfels. Sept. 1846.

This latter the type collection of *Asclepias longipetala* Scheele. Linn. **21 :** 757.

459. METASTELMA BARBIGERUM Scheele. New Braunfels. June-Aug. 1846. Rocky soil in cedar forest.

Type collection; Linn. **21 :** 760.

460. ROULINIA UNIFARIA Engelm. L. 352. New Braunfels. Aug. 1846. Type collection of *Gonolobus unifarius* Scheele. Linn. **21 :** 760.

461. GONOLOBUS RETICULATUS Engelm. L. 474. Comanche Spring. 1845.—L. 350. Upper Guadalupe. Sept. 1846. See Torrey, Mex. Bound. Surv. **2 :** 165; Proc. Amer. Acad. **12 :** 75.

GONOLOBUS BIFLORUS Nutt. L. 162. New Braunfels. April 1846. Mex. Bound. Surv. **2 :** 165.

462. [ERYTHRAEA TEXENSIS Griseb. New Braunfels. April 1848 (IV)].

463. E. TEXENSIS Griseb. L. 180. New Braunfels. June 1846.—L. 340. New Braunfels. July 1846.

464. E. BEYRICHII T. & G. L. 308. Upper Guadalupe. June 1845.—Sabinas River. July 1847 (IV).

465. GILIA RIGIDULA Benth. L. 144. New Braunfels. April 1846.—L. 279. Victoria. March 1845. *G. glandulosa* Scheele. Linn. **21 :** 754.

466. G. INCISA Benth. L. 214. Upper Guadalupe. June, July 1846.

Type collection of *G. Lindheimeriana* Scheele. Linn. **21 :** 753.

467. PHLOX ROEMERIANA Scheele. L. 428. Comale Spring. June 1845.—L. 429. San Antonio. April 1845.—New Braunfels. April 1848 (IV).

469. CONVOLVULUS SAGITTIFOLIUS Scheele. L. 170. New Braunfels. June 1846.—L. 319. New Braunfels. Aug. 1846.—L. 274. Comale Creek. May, June 1845.—New Braunfels. May 1848 (IV).

L. 319 appears to be the type collection, though Scheele (Linn. **21**: 747) gives July as the date of collection; the other label data are identical.

470. CONVOLVULUS INCANUS Vahl. L. 104. (New Braunfels). April, May 1846.—New Braunfels. May 1848 (IV). *C. sinuatus* Scheele. Linn. **21**: 748.

471. BOUCHETIA ANOMALA Britt. & Rusby. L. 796. Comale Spring. Aug. 1845.—L. 276. San Antonio. April 1845.

472. CUSCUTA EXALTATA Engelm. New Braunfels. 1846.

Type collection; Trans. Acad. Sci. St. Louis. **1**: 513.

473. C. VERRUCOSA Engelm. L. 152b. New Braunfels. May 1846.—L. 277. Upper Guadalupe. June 1845.

Engelmann says: "*C. verrucosa* in its transition to *C. pentagona*. Margins of woods on rocky soil, mixed with the usual form of *C. verrucosa*." See Trans. Acad. St. Louis. **1**: 495. *C. arvensis verrucosa* Engelm.

474. CUSCUTA HISPIDULA Engelm. San Antonio. April 1845.—New Braunfels. April 1846.

475. CUSCUTA PULCHERRIMA Scheele. L. 317. New Braunfels. Oct. 1846. Type collection; Linn. **21**: 750. *C. decora pulcherrima* Engelm.

476. NAMA JAMAICENSE L. L. 219. New Braunfels. Aug. 1846.

477. ECHINOSPERMUM TEXANUM Scheele. L. 70. San Antonio. April. 1846.

Possibly the type collection, though Scheele credits it to Roemer. *E. Redowskii cupulatum* Gray.

478. PHACELIA CONGESTA Hook. L. 423. Upper Guadalupe. May 1845.—L. 71. (New Braunfels). April 1846.

479. P. PATULIFLORA Engelm. & Gray. L. 295. Guadalupe near Victoria. Mar. 1845.—L. 294. Guadalupe. Feb. 1845. (280),

480. SOLANUM ROSTRATUM Dunal. L. 147 (450). (New Braunfels). May 1846.—L. 804 (494). Upper Guadalupe. Sept., Oct. 1845.

481. S. TRIQUETRUM Cav. var. LINDHEIMERIANUM Gray. L. 322. Victoria. Jan. 1845.—L. 312. New Braunfels. Aug. 1846.—Llano. Oct. 1847 (IV).—Victoria. July 1848 (IV). New Braunfels. April 1848.

L. 312 above is the type collection of *S. Lindheimerianum* Scheele. Linn. **21**: 766. It is doubtful if *S. triquetrum* and *S. Lindheimerianum* are more than large and small leaved forms of the same species and only study in their native habitat can determine this question with certainty.

482. CAPSICUM BACCATUM L. L. 320. Colorado bottom near Columbus. Jan. 1845.—L. 495. (New Braunfels). Aug. 1845.

483. NICOTIANA REPANDA Willd. L. 320. Guadalupe River bottom. Feb. 1845.—L. 72. Victoria near New Braunfels. Mar.-May 1846.

484. CHAMAESARACHA CORONOPUS Gray. L. 174. Guadalupe River. June 1846.

484b. C. CONIOIDES Britton. L. 74. San Antonio. April 1846.—L. 315. (New Braunfels). Aug. 1846.—New Braunfels. May 1848 (IV).

These two species appear to intergrade in Texas.

485. BUDDLEIA RACEMOSA Torr. June 1847-8 (IV).

The specimen of III not found. This is a co-type, according to the label; Mex. Bound. Surv. **2**: 121.

486. HERPESTIS CHAMAEDRYOIDES HBK. L. 322. (New Braunfels). Aug. 1846.—L. 381. Guadalupe River. Feb. 1845.

487. ANTIRRHINUM ANTIRRHINIFLORUM Small. 1847.

488. CASTILLEIA PURPUREA Don. L. 726 (329). San Antonio. April 1845.—L. 75. (New Braunfels). April 1846.

490. [STACHYS UMBROSA Scheele].

492. SCUTELLARIA VERSICOLOR Nutt. VAR. BRACTEATA Benth. L. 146. New Braunfels. May 1846.—New Braunfels. May 1848 (IV).

493. SALVIA TEXANA Torr. L. 81. New Braunfels. May 1846.

Type collection of *Salviastrum texanum* Scheele. Linn. **22**: 585. —Mex. Bound Surv. **2**: 132.

494. S. TEXANA Torr. L. 80. New Braunfels. May 1846.

495. HEDEOMA REVERCHONI Gray. L. 84. Guadalupe River. May 1846.

496. H. ACINOIDES Scheele. L. 374. Upper Guadalupe. May 1845.—L. 87? Upper Guadalupe. April 1846.

497. MONARDA CITRIODORA Cerv. L. 371. Comale Spring. June 1845.—L. 97. (New Braunfels). May 1846. *M. tenuiaristata* Small.

498. SALVIA FARINACEA Benth. L. 369. San Antonio. April 1845.

499. S. ROEMERIANA Scheele. L. 370. Comale Creek. April 1845.—L. 145. (New Braunfels). April 1846. —New Braunfels. April 1848 (IV).

500. VERBENA CANESCENS HBK. L. 77. (New Braunfels). April 1846.

See Torr. Mex. Bound. Surv. **2**:128. *V. Roemeriana* Scheele. Linn. **21**: 755.

501. V. CILIATA Benth. L. 324. San Antonio. April 1845. —L. 325. Comale Spring. May 1845.—San Antonio. April 1848 (IV).—New Braunfels. May 1848 (IV).

502. LIPPIA LIGUSTRINA Britton. L. 404. San Antonio. Aug. 1845.—L. 121. San Antonio. April 1846.—Llano River. Oct. 1847 (IV).

503. LANTANA HORRIDA HBK. L. 384. Upper Guadalupe. June 1845.—L. 306. New Braunfels. Aug. 1846.

504. CALOPHANES LINEARIS Gray. L. 158. Brazos River. June 1844.—L. 111. New Braunfels. May 1846.—L. 325. New Braunfels. Aug. 1846.

505. SIPHONOGLOSSA PILOSELLA Torr. Shady woods, New Braunfels. 1846.

506. RUELLIA DRUMMONDIANA Gray. L. 323. New Braunfels. Aug. 1846.—L. 268. On the Comale. June 1845.

L. 323 is the type collection of *Dipteracanthus Lindheimerianus* Scheele. Linn. **21**: 764.

507. MIRABILIS JALAPA L. L. 515. Upper Guadalupe. Aug. 1845.—L. 470. Comale Cr. Sept., Oct. 1845. —L. 158. New Braunfels. June 1846.

508. NYCTAGINEA CAPITATA Chois. L. 178. San Antonio. May 1846.—L. 268. San Antonio. Oct. 1846.—L. 470. New Braunfels. Oct. 1847 (IV).

509. BOERHAVIA HIRSUTA L. L. 469. Chocolate Bayou and Mill Cr. Aug., Sept. 1845.

510. B. LINEARIFOLIA Gray. L. 140. Upper Guadalupe. May, June 1846.

Apparently a co-type; Am. Jour. Sci. II. **15**: 322.

511. PLANTAGO WRIGHTIANA Decne. L. 422. Upper Guadalupe. April 1845.—May 1848 (IV).

512. ALTERNANTHERA REPENS Kuntze. L. 284. San Antonio. Aug. 1846.

Type collection of *A. villiflora* Scheele. Linn. **22**: 149.

513. AMARANTHUS ALBUS L. L. 147. Houston. May 1842.—L. 286a. New Braunfels. Aug. 1846.

514. IRESINE PANICULATA Kuntze. L. 520. Comale Cr. Nov. 1840.—Sept. 1845.

515. CHENOPODIUM HYBRIDUM L. L. 280. New Braunfels. Aug. 1846.

516. ERIOGONUM ANNUUM Nutt. L. 279. Guadalupe River. Aug. 1846.—New Braunfels. July 1847 (IV).

L. 279 is the type collection of *E. Lindheimerianum* Scheele. Linn. **22**: 149.

517. LINDERA BENZOIN Blume. L. 147. Comale Spring. March 1846.

518. ARGITHAMNIA MERCURIALINA Muell. L. 106. (New Braunfels). April & May 1846. Mueller. DC. Prod. **15**^{2}: 740.

519. STILLINGIA ANGUSTIFOLIA Engelm. L. 141. Upper

Guadalupe. June 1846.—L. 315. Upper Guadalupe. April 1845.

S. sylvatica linearifolia Muell. DC. Prod. **15²**: 1158.

520. ACALYPHA LINDHEIMERI Muell. L. 475. Llano River. Sept. 1847 (IV).

Type collection; Linn. **34**: 47.

521. TRAGIA STYLARIS Muell. var. ANGUSTIFOLIA Muell. L. 298. New Braunfels. July 1846.

Type collection; Linn. **34**: 180. Also the type collection of *T. scutellariaefolia* Scheele. Linn. **25**: 587, which Mueller refers to *T. nepetaefolia scutellariaefolia* Muell. DC. Prod. **15²**: 934, not knowing the two to be identical.

522. T. NEPETAEFOLIA Cav. var. TEUCRIIFOLIA Muell. L. 299. New Braunfels. July-Sept. 1846.

Type collection; DC. Prod. **15²**: 934. Also of *T. teucriifolia* Scheele. Linn. **25**: 586.

523. BERNARDIA MYRICAEFOLIA Wats. New Braunfels. May, June 1846. *Ricinella myricaefolia* Muell. DC. Prod. **15²**: 729.

524. B. MYRICAEFOLIA Wats. L. 223. New Braunfels. May, Sept. 1846.—L. 400. Upper Guadalupe. May 1845.

L. 223 is the type collection of *Tyria myricaefolia* Scheele. Linn. **25**: 581.

525. CROTON FRUTICULOSUS Engelm. L. 297b. New Braunfels. Aug. 1846. Mex. Bound. Surv. **2**: 194. *C. fruticulosus pallescens* Muell. DC. Prod. **15²**: 633.

526. C. LINDHEIMERIANUS Scheele. L. 304. New Braunfels. July 1846.—New Braunfels. May 1848 (IV).

L. 304 is the type collection; Linn. **25**: 580.

527. C. MONANTHOGYNUS Michx. L. 303. New Braunfels. July 1846.

528. EUPHORBIA ROEMERIANA Scheele. L. 89. (New Braunfels). April 1846.

Type locality; Linn. **22**: 151. Boiss. DC. Prod. **15²**: 143.

529. E. LONGICRURIS Scheele. L. 90a. New Braunfels. April.

1846.—L. 90b. Cibolo River. March 1846.—L. 313. Upper Guadalupe. April 1845.

L. 90a is the type locality; Linn. **22:** 152.

530. E. VILLIFERA Scheele. L. 487. Aug. 1845.—L. 293. New Braunfels. Aug., Sept. 1846.

The latter is the type collection; Linn. **22:** 153.

531. E. FENDLERI T. & G. L. 164. New Braunfels. June 1846.—L. 290. New Braunfels. July 1846.

The latter the type collection of *E. rupicola* Scheele. Linn. **22:** 153.

532. E. SERPENS HBK. L. 291a & 292. New Braunfels. Aug., Sept. 1846.

"*E. herniarioides* approaching var. *imbricata.*" Engelm., note in herb. Type collection of *E. flexicaulis* Scheele. Linn. **22:** 153.

533. E. PROSTRATA Ait. L. 165. New Braunfels. June 1846.

534. ANDRACHNE PHYLLANTHOIDES Coult. New Braunfels and San Antonio. April 1846.

536. GARRYA LINDHEIMERI Torr. L. 122. Upper Guadalupe. March & May 1846.—L. 216. New Braunfels. Aug. 1846.

Apparently a co-type collection; Pac. Ry. Surv. **4:** 136.

537. FORESTIERA PUBESCENS Nutt. L. 221, 222. New Braunfels. Feb. 1846.—New Braunfels. Feb. 1847 (IV).

538. F. ANGUSTIFOLIA Torr. L. 399. Matagorda Bay. Feb. 1845.

Co-type collection; Mex. Bound. Surv. **2:** 168.—Proc. Am. Acad. **4:** 365.

539. TILLANDSIA RECURVATA L. L. 617. Colorado River. Aug. 1845.

540. ALLIUM MUTABILE Michx. L. 114. New Braunfels. April 1846.

541. CAMASSIA FRASERI Torr. L. 116. New Braunfels. April 1846.

Type collection of *Ornithogalum texanum* Scheele. Linn. **25:** 146.

This and var. *angusta* Torr. apparently mixed in this collection.

542. COOPERIA PEDUNCULATA Herb. Comale Cr.? 1845.—1848.

543. SCHOENOCAULON DRUMMONDII Gray. L. 115. Prairies near New Braunfels. April 1846.

Type collection of *S. texanum* Scheele. Linn. **25**: 262.

544. ANDROSTEPHIUM COERULEUM Greene. L. 117. Upper Guadalupe. March 1846. Type collection of *Milla coerulea* Scheele. Linn. **25** : 260. *Androstephium violaceum* Torr.

547. POTAMOGETON LONCHITES Tuckerm. Caritas. Jan. 1845. (311).

548. DASYLIRION TEXANUM Scheele. L. 419. Upper Guadalupe. June 1845.

549. D. TEXANUM Scheele. L. 212. New Braunfels. June 1846.

550. NOLINA TEXANA Wats. L. 93. Upper Cibolo. March 1846.

Type collection; Proc. Amer. Acad. **14** : 248.

551. N. LINDHEIMERIANA Wats. L. 297. Upper Guadalupe. April, May 1846.—New Braunfels. June, July 1846. *Dasylirion Lindheimerianum* Scheele. Linn. **25** : 262; latter the type collection.

552. N. LINDHEIMERIANA Wats. L. 197 (672). Between Guadalupe and San Antonio Rivers. June 1845.

553. CYPERUS SPECIOSUS Vahl. L. 183a? New Braunfels. May 1846.

554. [C. TETRASTACHYA Scheele. Linn. **22** : 347.]

555. [C. MICRODONTA Torr. & Hook. *C. Roemeriana* Scheele. Linn. **22** : 346.]

556. [CAREX SCABERRIMA Scheele. Linn. **22** : 345.]

557. FUIRENA SIMPLEX Vahl. L. 185. New Braunfels. May 1846.—L. 184. New Braunfels. May 1846. —L. 186. Guadalupe River. May 1846.

558. AGROSTIS VERTICILLATA Vill. L. 128. New Braunfels. May 1846.

559. SPOROBOLUS DEPAUPERATUS Scribn. L. 452? Llano and Piedernales. Nov. 1847.

560. EATONIA OBTUSATA Gray. L. 127. Upper Guadalupe. May 1846.

561. [STIPA CILIATA Scheele.]

562. ARISTIDA AEQUIRAMEA Scheele. L. 398? San Antonio. April 1845.—L. 138? New Braunfels. Sept. 1846. The latter the type collection; Linn. **22**: 343. *A. purpurea californica* Vasey. *A. purpurea aequiramea* Murrill.

563. A. PURPUREA Nutt. L. 397. San Antonio. April 1845. *A. Roemeriana* Scheele. Linn. **22**: 343.

564. CHAETOCHLOA POLYSTACHYA Scribn. & Mer. L. 357. New Braunfels. Oct. 1846

Type collection of *Setaria polystachya* Scheele. Linn. **22**: 339.

565. PANICUM LINDHEIMERI Nash. L. 139? New Braunfels. May 1846. "Springy banks of the Guadalupe."

Type collection; Bull. Torr. Bot. Club. **24**: 196.

566. ERIOCHLOA SERICEA Munro. L. 354. New Braunfels. June 1846. "In wet places."

Type collection of *Paspalum sericeum* Scheele. Linn. **22**: 341.

567. PASPALUM PLICATUM Michx. L. 137. New Braunfels. April 1846. "Springy banks of the Guadalupe."

568. BOUTELOUA CURTIPENDULA Torr. L. 358. New Braunfels. Aug. 1846.

569. BUCHLOE DACTYLOIDES Engelm. L. 136. New Braunfels. April 1846.

570. FESTUCA OCTOFLORA Walt. L. 129. New Braunfels. April 1846.—L. 130. New Braunfels. April 1846.

571. ELYMUS CANADENSIS L. form. L. 184. Mill Creek. May 1844.

572. ANEIMIA MEXICANA Kl. New Braunfels. July 1847 (IV).

573. MARSILIA MACROPODA Engelm. L. 394. Swamps of the Guadalupe bottoms near Victoria. June 1845.

Type collection; Am. Jour. Sci. II. **3**: 56. n.

FASCICLE IV. 1847–1848.

652. MENODORA LONGIFLORA Gray. L. 426. Upper Guadalupe. June, July 1847. "Very sweet-scented, like Mayflowers." Type collection; Amer. Jour. Sci. II. **14**: 45. "High plateaus on the Upper Guadalupe, sparse on sterile, gravelly soil; many stems from a ligneous root: flower opening in the evening, closing toward noon; sweet-scented."

653. FRAXINUS BERLANDIERIANA DC. New Braunfels. July, Aug. 1847.—May 1848. "Bottom woods on the Guadalupe below New Braunfels."

653b. ASCLEPIODORA DECUMBENS Gray. Piedernales. 1847. —New Braunfels. May 1848.—New Braunfels. 1846.

654. MENODORA HETEROPHYLLA Moric. L. 383b. Guadalupe River. Feb. 1845.—Llano River. Oct. 1847.

655. ASCLEPIAS TEXANA Heller. L. 492. Upper Guadalupe. June 1847.

656. A. INCARNATA L. var. LONGIFOLIA Gray. L. 493. Piedernales near Friederichsburg. Sept. 1847.

657. A. VERTICILLATA L. L. 497. Piedernales at Friederichsburg. June 1847.

658. APOCYNUM CANNABINUM L. L. 399. Friederichsburg. June 1847.

659. A. CANNABINUM L. L. 398. Piedernales. June 1847.

660. AMSONIA CILIATA Walt. var. TEXANA Coult. L. 381. Piedernales River. April 1847.

661. IPOMOEA LEPTOPHYLLA Torr. Piedernales. June–Sept. 1847.—July 1848. "On bushes 2–3 feet high; open prairies."

662. EVOLVULUS ARGENTEUS Pursh. L. 411. New Braunfels. June 1847.—New Braunfels. April 1848.

Pubescence thinner and lighter colored than in the typical form, possibly approaching *E. mollis* Small.

663. DICHONDRA REPENS Forst. New Braunfels. Feb., May 1848.

665. EHRETIA ELLIPTICA DC. Guadalupe River. March 1848.

666. NEMOPHILA PHACELIOIDES Nutt. New Braunfels. April 1848.

667. SOLANUM ELAEAGNIFOLIUM Cav. L. 474. Llano River. Oct. 1847.

668. CHAMAESARACHA CORONOPUS Gray. L. VI. Llano River. Aug. 1848.

669. CASTILLEIA PURPUREA Don. L. 385. April 1847.

670. SEYMERIA BIPINNATISECTA Seem. var. TEXANA Gray. L. 468. Friederichsburg. Sept. 1847.—Piedernales and Llano. July 1848.

671. MIMULUS GLABRATUS HBK. Guadalupe River near New Braunfels. May 1848.

672. SALVIA FARINACEA Benth. New Braunfels. April, May 1848.

673. S. PENTSTEMONOIDES Kunth. L. 460. Upper Piedernales. Oct. 1845.

674. SCUTELLARIA WRIGHTII Gray. L. 382. Friederichsburg. Apr., May 1847.

675. TEUCRIUM LACINIATUM Torr. L. 383. Comanche Spring. April 1847.

676. LIPPIA NODIFLORA Michx. L. 502. Sabine River. Aug. 1847.

677. CALOPHANES LINEARIS Gray. New Braunfels. May 1848.

679. ACLEISANTHES LONGIFLORA Gray. L. 471. Llano River. Oct. 1847.

Co-type collection; Am. Jour. Sci. II. **15**: 316.

680. NYCTAGINEA CAPITATA Chois. L. VIII. Llano River. July 1848.

681. ALLIONIA NYCTAGINEA Michx. var. LATIFOLIA Gray. New Braunfels. May 1848.

Co-type collection; Mex. Bound. Surv. **2**: 174.

682. GOSSYPIANTHUS RIGIDIFLORUS Hook. L. 472. Llano River. Oct. 1847.

683. ERIOGONUM TENELLUM Nutt. var. RAMOSISSIMUM

Benth. L. 476. N. of Friederichsburg. Sept. 1847. "Granitic mountains."

Co-type collection; DC. Prod. **14**: 20.

684. E. LONGIFOLIUM Nutt. New Braunfels. June 1847.

"On rocky mountains on the plateaus."

685. POLYGONUM SCANDENS L. L. 480. Llano River. Oct. 1847.

686. ARGITHAMNIA APHOROIDES Muell. L. 386. Upper Guadalupe. April 1847.

Type collection; DC. Prod. **15²**: 738.

687. STILLINGIA ANGUSTIFOLIA Engelm. 1847. Proc. Amer. Acad. **18**: 154. *S. sylvatica linearifolia* Muell. DC. Prod. **15²**: 1158.

688. ACALYPHA LINDHEIMERI Muell. L. 382. Upper Guadalupe. May–Aug. 1845.

Co-type collection; Linn. **34**: 47.

689 & 690. A. RADIANS Torr. var. GERANIIFOLIA Muell. L. 473. Llano River. Oct. 1847. Type collection; Linn. **34**: 52.

691. CROTON GLANDULOSUS L. var. LINDHEIMERI Muell. L. v. Llano River. Aug. 1848. Type collection; DC. Prod. **15²**: 685.

691b. C. GLANDULOSUS L. var. SEPTENTRIONALIS Muell.

Type collection; DC. Prod. **15²**: 686.

692. C. MONANTHOGYNUS Michx. L. 302. New Braunfels. July 1846.

693. EUPHORBIA SERPENS HBK. L. 1. Llano River. Aug. 1848.

694. E. ANGUSTA Engelm. "From the crevices of limestone rocks from a thick, black, ligneous root; many erect stems. On the knobs near the Cibolo and Sabinas." June, July 1847.

695. E. NUTANS Lag. L. 443. Friederichsburg. Sept. 1847.—L. 451. Piedernales. Sept. 1847.

696 & 697. E. HETEROPHYLLA L. New Braunfels. April 1848.

698. E. LONGICRURIS Scheele. New Braunfels. April, May 1848.

699. E. ROEMERIANA Scheele. New Braunfels. April 1848.

700. FORESTIERA PUBESCENS Nutt. New Braunfels. Feb., May 1848. "Shady woods near water."

701. MORUS MICROPHYLLA Buckl. New Braunfels. May 1848.

702. URTICA CHAMAEDRYOIDES Pursh. New Braunfels. April 1848.

705. NAIAS GUADALUPENSIS Morong var. L. 439. New Braunfels. 1847.

A small diffuse form about 1 cm. high with leaves 4–7 mm. long.

707. COOPERIA DRUMMONDII Herb. L. 454. New Braunfels. Aug. 1847.

708. NEMASTYLIS ACUTA Herb. New Braunfels. April 1848.

709. YUCCA RUPICOLA Scheele. L. 326. New Braunfels. June 1846.—New Braunfels. April 1848. Mex. Bound. Surv. **2**: 221.

710. ANDROSTEPHIUM COERULEUM Greene. New Braunfels. May 1848. *A. violaceum* Torr. Co-type collection; Mex. Bound. Surv. **2**: 219. Type locality.

711. SCHOENOCAULON DRUMMONDII Gray. (New Braunfels). May 1848.

712. NOLINA TEXANA Wats. L. 298. San Antonio. May 1845.—(New Braunfels). May 1846. Co-type collection; Proc. Am. Acad. **14**: 248.
"On rocky soil; bushes 4–6 feet high, gregarious; characteristic of the mountain region."

713. SAGITTARIA PLATYPHYLLA J. G. Smith. L. 437. New Braunfels. July 1847. See Rep. Mo. Bot. Gard. **6**: 56.

714. ECHINODORUS CORDIFOLIUS Griseb. L. 438. New Braunfels. July 1847.—Cibolo River. June 1847.

Plants vary from 5 cm. to 6 dm. high.

715. COMMELINA VIRGINICA L. New Braunfels. June 1848.

716. C. ANGUSTIFOLIA Michx. New Braunfels. May 1848.
717. DICHROMENA COLORATA Hitchk. L. 500. Piedernales River. Sept. 1847.
718. D. NIVEA Boeckl. L. 417. Between the Piedernales and Llano. June 1847. "In shallow basins of decomposed limestone, on rocky knobs."
719. ELEOCHARIS CELLULOSA Torr. L. 494. Friederichsburg. Sept. 1847. "In swampy places."
720. CENCHRUS TRIBULOIDES L. Piedernales. Oct. 1847.
722. PANICUM LACHNANTHUM Gray. 1847.
723. P. LACHNANTHUM Gray. L. 449 & 450. Llano River. Oct. 1847.
724. SPOROBOLUS CRYPTANDRUS Gray var. STRICTUS Scribn. Dry mountain prairies on the Llano. Oct. 1847.

A small slender form with the panicles partly or wholly included in the upper leaf sheath (var. *expansa* Thurber in Engelm. Herb.)

725. EPICAMPES DISTICHOPHYLLA Vasey var. MUTICA Scribn. L. 465. Friederichsburg. Sept. 1847.
726. SPOROBOLUS ASPER Kunth. L. 446. Llano River. Oct. 1847. In rocky soil.
727. THURBERIA ARKANSANA Benth. New Braunfels. May 1848.
728. PANICUM CURTISII Steud. 1847.
729. MELICA DIFFUSA Pursh. L. 389. Piedernales River. May 1847.
730. CHLORIS VERTICILLATA Nutt. var. ARISTULATA Torr. L. 448. Llano. Oct. 1847.
731. BOUTELOUA HIRSUTA Lag. L. 496. Friederichsburg. Sept. 1847.
732. B. TEXANA Wats. L. (7). Llano. Oct. 1847.

Co-type collection; Proc. Am. Acad. **18**: 196.

733. PANICUM VIRGATUM L. L. 488. Llano River. Oct. 1847.

P. giganteum Scheele. Linn. **22**: 340.

734. ERAGROSTIS INTERRUPTA Trelease. 1847.

See Beal's Grasses of N. Am. **2**: 483.

735. E. INTERRUPTA Trelease. L. 453. Piedernales River. Nov. 1847.

736. E. TRICHODES Nash. ?L. 447. Llano River. Oct. 1847.

737. SIEGLINGIA ALBESCENS Kuntze. Llano River. Oct. 1847.

738. S. ACUMINATA Kuntze. L. 455. 30 mi. N. of Friederichsburg. Oct. 1847.

739. ELYMUS VIRGINICUS L. L. 134. New Braunfels. May 1846.

740. CHRYSOPOGON AVENACEUS Benth. L. 460. Friederichsburg. Oct. 1847.

741. ANDROPOGON FURCATUS Muhl. L. 495. Piedernales River. Sept. 1847.

742. DRYOPTERIS PATENS Kuntze. L. 434. New Braunfels. July 1847. "Shady, rocky river banks." See Hooker, Sp. Fil. **4**: 96.

743. CHEILANTHES TOMENTOSA Link. L. 442. On granite peaks 5 mi. N. of Friederichsburg. Sept. 1847. Torr. Bull. **30**: 352.

744. CHEILANTHES LINDHEIMERI Hook. L. 441. On granite peaks 5 mi. N. of Friederichsburg. Sept. 1847.

Type collection; Hooker, Sp. Fil. **2**: 101. Torr. Bull. **30**: 353.

745. MARSILIA TENUIFOLIA Engelm. L. 374. "Ponds in shady woods on the Piedernales." May 1847.

Type collection; Am. Jour. Sci. II. **6**: 89. n.—A. Br. Mars. & Pil. 740.

746. M. UNCINATA A. Br. var. TEXANA. A. Br. L. 404. "In the pools in the mountains between the Cibolo and Upper Guadalupe." June 1847.

Type collection; A. Br. Marsil. & Pilul. 742. 1870.

747. CHARA INTERMEDIA A. Br. forma *gracilior*. Friederichsburg? 1847. C. *contraria* A. Br. var. *robusta* A. Br. See Braun-Nordstedt, Fragmente. 153, 154.

748. C. CONTRARIA A. Br. forma *minor*. Friederichsburg. 1847. See Braun-Nordstedt, Fragmente. 144.

749. C. CONTRARIA A. Br. var. HISPIDULA A. Br. L. 747a. Piedernales. Oct. 1845. C. *Lindheimeri*

A. Br. and *C. contraria Lindheimeri* A. Br. Braun-Nordstedt, Fragmente. 145. Type collection.

750. C. FOETIDA A. Br. Friederichsburg. 1847. Braun-Nord., Frag. 163.

751. C. GYMNOPUS A. Br. var. CONJUGENS A. Br. Friederichsburg. Oct. 1847. *C. (polyphylla) conjugens* A. Br. Braun-Nord., Frag. 195.

752. C. GYMNOPUS A. Br. var. HUMBOLDTII A. Br. Friederichsburg. Oct. 1847. C. *Humboldtii* A. Br. *C. polyphylla Humboldtii* and *C. polyphylla Muhlenbergii* A. Br. Pl. Lind. 1:56. Braun-Nordt., Frag. 195.

753. NITELLA PRAELONGA A. Br. L. XX. Three Creeks between the Upper Guadalupe and the Piedernales. July 1848.

754. RICCIA FLUITANS L. "On the muddy bottom of Comale Creek under water." 1847.

SPECIES COLLECTED IN COMAL COUNTY AND REGION ADJACENT IN 1849–1851.

In the following list the general sequence of orders is that of the published "Plantae Lindheimerianae," and the numbers immediately succeed those of Part II, so as to secure general uniformity with that publication, of which this is a continuation. Each number represents a separate collection and, when the species is the same as that of a previous collection, the number of such previous species follows in parenthesis, those of the unpublished issues being preceded by III or IV to indicate the fascicle. After the specific name, is given Lindheimer's collection number (L.), as these have been quoted in a number of publications from sets or specimens already distributed. The regularity with which he numbered his collections has made it possible to supply much of the missing data for each number, but all localities and dates thus supplied are given in parenthesis, so as to distinguish them from data found on labels. The references given are mainly to literature where the specimens are quoted or the synonym mentioned. The genus *Carex* is strangely missing from this collection and it is probable that it was sent to some specialist and misplaced or forgotten, as Lindheimer was urged by Gray not to neglect this genus, as collectors are so apt to do.

In this and the preceding lists I have used the term "type collection" to signify the collection from which the original description of the species was made; "co-type" or "co-type collection," to indicate other collections quoted in this description after that first mentioned; and the term "type locality," to indicate other specimens collected later at the locality from which the type collection came.

New Braunfels, where most of the specimens were collected and where Lindheimer had his home, is at the junction of Comal Creek with the Guadalupe River, apparently called the Upper Guadalupe above this point, while Comanche Spring is on one of the heads of the Salado some 25 miles south of west of New Braunfels, and later known as von Meusebach's farm.

652. CLEMATIS DRUMMONDII T. & G. L. 338. (New Braunfels). July 1850. (319).

653. C. DRUMMONDII T. & G. (New Braunfels). Sept. 1850.

654. C. PITCHERI T. & G. L. 384. New Braunfels. June 1850. (5 in part).

655. C. PITCHERI T. & G. L. 625. New Braunfels. May 1851.

656. C. COCCINEA Engelm. L. 624. (New Braunfels. Aug. 1851).

657. C. COCCINEA Engelm. (New Braunfels. Aug. 1851).

658. C. COCCINEA Engelm. L. 383. New Braunfels. June 1850.

"Rocky and shady banks." Co-type collection; Plantae Wrightianae. 2:7.

659. RANUNCULUS MACRANTHUS Scheele. L. 435. New Braunfels. March 1850. (320). Type locality; Linn. **21**: 585.

Heads of carpels sometimes oblong-ovate.

660. DELPHINIUM AZUREUM Michx. var. VIMINEUM Gray. L. 360. New Braunfels. April (1850). (321).

Plants mostly small, 3-6 dm. high, and leaves mainly aggregate at base.

661. BERBERIS TRIFOLIOLATA Moricand. L. 539. (New Braunfels). May 1851. (322, 575).

662. NELUMBO LUTEA Pers. L. 646. Cibolo River. June 1851.

663. CORYDALIS CURVISILIQUA Engelm. L. 546. (New Braunfels). May 1851. Type collection; Pl. Wright. 2:10.

Gray gives the collection number as 433, but the type in the Engelmann herbarium shows it to be the same as this.

664. DRABA CUNEIFOLIA Nutt. L. 418. New Braunfels. March 1850. (216).

665. D. CUNEIFOLIA Nutt. L. 516. New Braunfels. 1851.

666. LESQUERELLA ENGELMANNI Wats. L. 526. New Braunfels. April 1851. (325, 576). Apparently the type locality.

667. L. ENGELMANNI Wats. L. 421. New Braunfels. May 1850.

668. L. GRACILIS Wats. L. 266. (New Braunfels). April 1850. (331).

669. L. GRACILIS Wats. var. SESSILIS Wats. L. 301. New Braunfels. May 1850.

670. L. ARGYREA Wats. L. 367. New Braunfels. April 1850. (329).

671. LEPIDIUM MEDIUM Greene. L. 462. New Braunfels. May 1850.

L intermedium? Gray; Pl. Wright. 2:15.

672. L. LASIOCARPUM Nutt. L. 459. New Braunfels. April 1850. Pl. Wright. 2:13.

673. L. LASIOCARPUM Nutt. L. 460. New Braunfels. March, May 1850.

674. ARABIS PETIOLARIS Gray. L. 464. (New Braunfels. May, 1850).

675. A. PETIOLARIS Gray. L. 547. (New Braunfels). May 1851.

676. STREPTANTHUS BRACTEATUS Gray. L. 19. (Comanche Spring). April 1849. (p. 143).

677. LECHEA TENUIFOLIA Michx. L. 344. New Braunfels. June 1850.

678. L. TENUIFOLIA Michx. L. 54. Comanche Spring. June 1849.

678a. IONIDIUM POLYGALAEFOLIUM Vent. New Braunfels. May 1851.

678b. VIOLA OBLIQUA Hill. L. 285. New Braunfels. May 1850.

679. STELLARIA PROSTRATA Baldw. L. 413. (New Braunfels). Jan. 1850. (336).

680. ARENARIA BENTHAMII Fenzl. L. 544. New Braunfels. Aug. 1851.

681. CALLIRHOË PEDATA Gray. L. 550? New Braunfels. May 1851. (349).

682. MALVASTRUM TRICUSPIDATUM Gray. L. 295. New Braunfels. June 1850. (351).

683. M. Wrightii Gray. L. 304. (New Braunfels). July 1850. (350).

684. Pavonia lasiopetala Scheele. L. 332. New Braunfels. June 1850. (352). Type locality; Linn. **21**: 470.

685. Malvaviscus Drummondii T. & G. L. 108. (Comanche Spring). Aug. 1849. (25).

686. Guaiacum angustifolium Engelm. L. 559. (New Braunfels). April 1851. (582).

687. Melochia pyramidata L. L. 299. New Braunfels. June 1850. (356).

688. Linum rupestre Engelm. L. 76. Comanche Spring. July 1849. (337). Co-type collection; Pl. Lind. 2: 232.

689. L. Berlandieri Hook. L. 365. New Braunfels. April 1850. (22, 581).

690. Erodium texanum Gray. L. 259. New Braunfels. April 1850. (340).

Co-type locality; Pl. Lind. 2:157, which doubtless represents the specimens from which Gray drew his description in Gen. Ill. **2**: 130.

691. Oxalis Drummondii Gray. L. 175. (New Braunfels). 1850. (341).

692. Galphimia angustifolia Benth. L. 69. Comanche Spring. June, July 1849. (361).

693. Thamnosma texanum Torr. L. 3. Comanche Spring. May 1849. (343).

694. Ptelea Baldwinii T. & G. L. 533. (New Braunfels). April 1851.

695. P. Baldwinii, T. & G. New Braunfels. June 1851.

A form with shorter and wider leaves somewhat pubescent below.

696. Xanthoxylum Clava-Herculis L. var. fruticosum Gray. L. 339. New Braunfels. April 1850.

697. X. Clava-Herculis L. var. fruticosum Gray. New Braunfels. April 1850.

698. Ilex decidua Walt. L. 417. (New Braunfels). March 1850.

699 RHAMNUS CAROLINIANA Walt. L. 387. New Braunfels. Sept. 1850. (227).

700. CONDALIA OBOVATA Hook. L. 293. New Braunfels. April 1850. (366, 589).

701. C. OBTUSIFOLIA Weber. (New Braunfels. 1851?). (364, 588).

702. C. LYCIOIDES Weber. L. 364. New Braunfels. April 1850. (p. 168, n.).

703. C. LYCIOIDES Weber. L. 578. New Braunfels. June 1851.

Form tending toward *C. obtusifolia* Web.

704. CEANOTHUS OVATUS Desf. L. 6. Comanche Spring. March 1849. (p. 170).

5 dm. or more high.

705. C. OVATUS Desf. L. 572. (New Braunfels). April 1851.

1.5 dm. high.

706. C. OVATUS Desf. L. 517. New Braunfels. March 1851.

1–5 dm. high.

707. C. OVATUS Desf. L. 436. New Braunfels. March 1850.

708. COLUBRINA TEXENSIS Gray. L. 424. New Braunfels. March 1850. (365).

709. C. TEXENSIS Gray. L. 283. New Braunfels. March 1850.

710. C. TEXENSIS Gray. L. 286. New Braunfels. June 1850.

A form tending toward *C. stricta* Engelm.

711. C. STRICTA Engelm. New Braunfels. June 1850. The type coliection; Pl. Wright. 1:33.

712. C. STRICTA Engelm. L. 582. New Braunfels. June 1850. Co-type collection.

713. C. STRICTA Engelm. New Braunfels. June 1850. Co-type coilection.

714. C. STRICTA Engelm. New Braunfels. 1850. Co-type collection.

715. VITIS RUPESTRIS Scheele. L. 13? (Comanche Spring). 1849.
716. V. AESTIVALIS Michx. L. 312. New Braunfels. May 1850. (359).
717. CISSUS AMPELOPSIS Pers. L. 348. New Braunfels. June 1850.
718. C. STANS Pers. L. 307. New Braunfels. July 1850. (26).
719. C. INCISA Desmoul. L. 497. (New Braunfels). Aug. 1850. (166).

Leaves mostly simple but more or less three-lobed.

720. AMPELOPSIS HEPTAPHYLLA Buckl. New Braunfels. 1850.
721. A. HEPTAPHYLLA Buckl. L. 550. New Braunfels. May 1851.
722. SAPINDUS DRUMMONDII H. & A. L. 579. (New Braunfels). May 1851. (226, 587).
723. UNGNADIA SPECIOSA Endl. L. 515. New Braunfels. 1850. (363, 586).
724. U. SPECIOSA Endl. L. 422? (New Braunfels. Aug. 1851?).
725. AESCULUS OCTANDRA Marsh. New Braunfels. (March) 1850.
726. A. OCTANDRA Marsh. var. HYBRIDA Sargent. L. 423b. New Braunfels. April 1850. (225, 362).
727. A. OCTANDRA Marsh. var. HYBRIDA Sarg. L. 531. New Braunfels. March 1851.
728. RHUS COPALLINA L. var. LEUCANTHA DC. L. 452. (New Braunfels). July 1850. (345).
729. R. VIRENS Lindh. L. 430. New Braunfels. Oct. 1850. (348). Type locality.
730. R. VIRENS Lindh. L. 480. (New Braunfels. April 1850).
731. R. VIRENS Lindh. L. 210. New Braunfels. Nov. 1849. Type locality.
732. R. TRILOBATA Nutt. New Braunfels. March 1850.
733. R. TRILOBATA Nutt. L. 16. (Comanche Spring). May 1849.

734. R. MICROPHYLLA Engelm. L. 425. New Braunfels. March 1850. Type collection; Pl. Wright. 1:31.

735. R. MICROPHYLLA Engelm. L. 337. (New Braunfels). May 1850. Co-type.

736. POLYGALA ALBA Nutt. L. 545. (New Braunfels. Oct.) 1851. (220).

Plants unusually large, 3-5 dm. high.

737. KRAMERIA SECUNDIFLORA DC. L. 80. Comanche Spring. (July) 1849. (13, p. 151).

738. ACACIA FILICIOIDES Trelease. L. 550. New Braunfels. May 1851. (49).

739. A. ROEMERIANA Scheele. L. 25. Comanche Spring. April 1849. (387, 604, 605).

740. A. ROEMERIANA Scheele. L. 530. (New Braunfels. April 1851).

741. A. ROEMERIANA Scheele. L. 566. (New Braunfels. May 1851).

742. AMORPHA FRUTICOSA L. L. 455. (New Braunfels). Aug. 1850. (595).

743. A. TEXANA Buckl. L. 296. (New Braunfels). May 1850.

APIOS TUBEROSA Moench. (New Braunfels). 1850.

744. ASTRAGALUS CARYOCARPUS Ker. L. 400. New Braunfels. March 1850. (596, 598, 230).

745. A. CARYOCARPUS Ker. L. 347. (New Braunfels. June 1850).

746. A. LINDHEIMERI Engelm. L. 258. Santa Clara, 10 mi. S. of New Braunfels. April 1850. "On rich muskit soil near water."

Co-type collection; Pl. Wright. 1:52. Specimens unusually large.

747. A. LINDHEIMERI Engelm. L. 542. (New Braunfels). April 1851.

748. A. NUTTALLIANUS DC. var. TRICHOCARPUS T. & G. L. 394. New Braunfels. March 1850. (45). *Hamosa austrina* Small.

749. A. WRIGHTII Gray. L. 8. (Comanche Spring. April 1849?). (p. 176).

750. Cassia Lindheimeriana Scheele. L. 494. New Braunfels. Aug. 1850. (380). Type locality.
751. C. Roemeriana Scheele. L. 120. San Antonio. June 1849. (381).
752. Cercis occidentalis Torr. L. 514. (New Braunfels). March 1851. (377).
753. C. occidentalis Torr. L. 592. (New Braunfels. June 1851).
754. Dalea aurea Nutt. L. 253. (New Braunfels). June 1850. (39).

Leaflets 5–7, longer and more narrowly oblanceolate than the normal of the species, sparsely appressed pubescent, or glabrous, bright green above and usually drying flat. A form apparently confined to Texas.

755. D. aurea Nutt. L. 607. (New Braunfels). July 1851.

These specimens show a decided tendency to form several small heads instead of one large one.

756. D. frutescens Gray. L. 104? Comanche Spring. Aug. 1849. (376).
757. D. laxiflora Pursh. L. 78. (Comanche Spring). June 1849. (375).
758. Desmanthus acuminatus Benth. L. 601. (New Braunfels). June 1851.
759. D. leptolobus T. & G. L. 578. New Braunfels. June 1851.
760. D. leptolobus T. &. G. L. 595. New Braunfels. June 1851.
761. D. reticulatus Benth. (New Braunfels. April 1851?).
762. D. reticulatus Benth. L. 600. New Braunfels. June 1851.
763. D. velutinus Scheele. (New Braunfels). June 1851. Type locality; Linn. **21:** 455.
764. D. velutinus Scheele. L. 131. Comanche Spring. June 1849. (385).
765. D. velutinus Scheele. L. 613. (New Braunfels. Aug. 1851?).

765a. DESMODIUM LINDHEIMERI Vail. L. 499. New Braunfels. Nov. 1850. Co-type collection; Bull. Torr. Bot. Club. **18** : 120; **19** : 111.

766. DESMODIUM WRIGHTII Gray. L. 551. New Braunfels. May 1851. (177).

766a. D. PANICULATUM DC. var. PUBENS T. & G. New Braunfels. Sept. 1850.

767. EYSENHARDTIA AMORPHOIDES HBK. L. 245. New Braunfels. (July) 1850. (374).
GALACTIA TEXANA Gray. (Comanche Spring). 1849. (591).

768. INDIGOFERA LEPTOSEPALA Nutt. L. 281. New Braunfels. May 1850. (34).

769. I. LINDHEIMERIANA Scheele. L. 303. (New Braunfels). 1850. (p. 172).

770. I. LINDHEIMERIANA Scheele. (New Braunfels). June 1850.

770a. LATHYRUS PUSILLUS Ell. L. 586. New Braunfels. May 1851.

771. LUPINUS SUBCARNOSUS Hook. L. 573. (New Braunfels). March 1850. (231). Form *L. texensis* Hook.

772. ACACIA FARNESIANA Willd. L. 432. (New Braunfels). March 1850. (51).

773. MIMOSA FRAGRANS Gray. L. 26. Comanche Spring. April 1849. (606, 607).

774. M. LINDHEIMERI Gray. L. 581. (New Braunfels. May 1851). (383).

775. NEPTUNIA LUTEA Benth. L. 229. New Braunfels. June 1850. (48).

776. PROSOPIS JULIFLORA DC. L. 278. New Braunfels. May 1850. (233, 382).

777. PSORALEA CUSPIDATA Pursh. L. 540. (New Braunfels). April 1851. (372).

778. P. CYPHOCALYX Gray. L. 44. (Comanche Spring). June 1849. (593).

779. P. RHOMBIFOLIA T. & G. L. 557. (New Braunfels). May 1851.

780. P. RHOMBIFOLIA T. & G. L. 291. (New Braunfels). June 1850.

781. RHYNCHOSIA MENISPERMOIDES DC. New Braunfels. July 1850. (30).

782. R. MINIMA DC. L. 486. New Braunfels. Sept. 1850. (29). "Climbing high over the grasses."

783. R. TEXANA T. & G. New Braunfels. 1851. (369).

784. R. TEXANA T. & G. var. ANGUSTIFOLIA Gray. L. 412. New Braunfels. July 1850. Type collection; Pl. Wright. 1:44.

785. SCHRANKIA ROEMERIANA (Scheele). L. 68. Comanche Spring. April? 1849. (384). Type locality. *Mimosa Roemeriana* Scheele.

786. S. ROEMERIANA (Scheele). L. 68a. Comanche Spring. June 1849.

787. SESBANIA MACROCARPA Muhl. New Braunfels. 1849. (371).

788. S. MACROCARPA Muhl. L. 398. (New Braunfels). Aug. 1850.

788a. SOPHORA SECUNDIFLORA Lag. L. 509. New Braunfels. March 1851.

788b. VICIA LEAVENWORTHII T. & G. L. 361. New Braunfels. April 1850. (590).

788c. V. TEXANA Small. L. 439. New Braunfels. March 1850.

V. caroliniana texana T. & G.

789. PRUNUS MINUTIFLORA Engelm. L. 401. (New Braunfels). March 1850. (388).

790. P. RIVULARIS Scheele. L. 604. (New Braunfels). July 1851. (389).

791. RUBUS TRIVIALIS Michx. L. 443. New Braunfels. March 1850.

792. FENDLERA RUPICOLA Engelm. & Gray. L. 257. New Braunfels. May 1850.

Type collection; Pl. Wright. 1:78, where it is described as var. *Lindheimeri* Engelm. & Gray.

793. F. RUPICOLA Engelm. & Gray. L. 506. New Braunfels. March 1851.

"Perpendicular rocks on the Upper Guadalupe 6 miles above New Braunfels." Apparently the type locality.

794. F. RUPICOLA Engelm. & Gray. L. 506b. New Braunfels. 1851.

795. SEDUM TORREYI Don. L. 241. New Braunfels. May 1850. (245).

796. LYTHRUM LINEARIFOLIUM Small. L. 30. Comanche Spring. June 1849. (188).

797. L. LINEARIFOLIUM Small. L. 110. Comanche Spring. Aug. 1849.

798. L. LINEARIFOLIUM Small. L. 248. New Braunfels. July 1850.

799. L. ALATUM Pursh. L. 101. (Comanche Spring). Aug. 1849.

Leaves scarcely clasping at base, sometimes even cuneate, and obtuse or rounded at apex.

800. GAURA COCCINEA Nutt. L. 43. Comanche Spring. May 1849.

A sparsely canescent, large-leaved form near var. *glabra* T. & G.

801. G. PARVIFLORA Dougl. L. 560. (New Braunfels). May 1851. (241).

802. G. SINUATA Nutt. L. 230. New Braunfels. (June) 1850. (60).

The small, narrow, glabrous-leaved form.

803. G. SINUATA Nutt. L. 529. New Braunfels. April 1851.

Glabrous form; lower leaves much larger and more deeply lobed than the upper.

804. G. SINUATA Nutt. L. 538. (New Braunfels). April 1851.

A large-leaved, canescent form, apparently tending toward *G. Drummondii* T. & G.

805. G. SUFFULTA Engelm. L. 558. (New Braunfels). April 1851. (611).

The type locality and very similar to the type specimens.

806. JUSSIAEA SUFFRUTICOSA L. L. 397. New Braunfels. July 1850.

807. LUDWIGIA NATANS Ell. L. 640. (New Braunfels. July) 1851. (395).

808. OENOTHERA JAMESII T. & G. L. 305. (New Braunfels). Aug. 1850. (p. 189).

809. O. SERRULATA Nutt. var. SPINULOSA T. & G. L. 272. New Braunfels. May 1850. (238, 393).

810. O. SINUATA L. L. 368. New Braunfels. April 1850.

811. O. SPECIOSA Nutt. L. 82. Comanche Spring. June 1849. (55).

812. O. TRILOBA Nutt. L. 522. New Braunfels. April 1851. (392).

813. STENOSIPHON LINIFOLIUM Britton. L. 100. Comanche Spring. Aug. 1849. (242).

814. EUCNIDE BARTONIOIDES Zucc. L. 419. (New Braunfels. March) 1850. (p. 191).

815. MENTZELIA NUDA T. & G. L. 126. Cibolo River. July 1849. (p. 191).

A small-flowered form.

816. M. OLIGOSPERMA Nutt. L. 121. Comanche Spring. June 1849. (396).

817. PASSIFLORA AFFINIS Engelm. L. 174. Comanche Spring. Aug., Sept. 1849.

The type collection; Pl. Lind. 2:233.

818. CUCURBITA FOETIDISSIMA HBK. L. 406. (New Braunfels. March) 1850. (398).

The *C. perennis* of Gray and type locality; Pl. Lind. 2:193.

819. C. FOETIDISSIMA HBK. L. 588. (New Braunfels. May 1851).

820. C. TEXANA Gray. L. 577. (New Braunfels. March 1851). (400).

Considered by Lindheimer as his *C. texana* and apparently from the same region as his type, but most of these specimens approach more nearly the normal leaf of *C. Pepo* L., of which it is probably only a wild form.

"The small, wild Texas pumpkin (*Cucurbita texana*) is excellent protection against mice and seed-eating insects. Its narrow neck can be easily closed with a cork and the name of the contents written on the outside."—Lindheimer, Aufsätze u. Abhandlungen. 54.

821. C. TEXANA Gray. L. 135. (Comanche Spring). 1849.

Leaves mostly divided as in the typical *C. texana*, but in part lobed much as in *C. Pepo*.

822. MAXIMOWICZIA LINDHEIMERI Cogn. L. 589. (New Braunfels). May 1851. (612).

Type locality and specimens very similar to the type.

823. MELOTHRIA CHLOROCARPA Engelm. L. 465. (New Braunfels. May 1850).

Apparently the type collection; Pl. Wright. 1:74.

824. M. CHLOROCARPA Engelm. L. 520. New Braunfels. July 1851. Type locality.

825. SICYOS ANGULATA L. L. 331. (New Braunfels. June) 1850. (397).

826. OPUNTIA MACRORHIZA Engelm. L. 597. New Braunfels. (July) 1850. (206)

Type locality.

827. O. MACRORHIZA Engelm. L. 597b. (New Braunfels), May 1851. (p. 206).

This and No. 826 seem to be the oldest specimens of this species in the Engelmann Herbarium, with the exception of a few flowers and fruits preserved from cultivated plants.

828. O. VAGINATA Engelm. L. 537. (New Braunfels. April) 1851.

829. MOLLUGO VERTICILLATA L. (No data).

830. BIFORA AMERICANA Wats. L. 340. New Braunfels. May 1850. (405).

831. B. AMERICANA Wats. L. 340a. (New Braunfels). June 1850.

832. DISCOPLEURA LACINIATA Wats. L. 79. Comanche Spring. July 1849. (404).

833. D. LACINIATA Wats. L. 79a. Comanche Spring. July 1849.

This appears to be a co-type; Pl. Lind. 2:211.

834. D. LACINIATA Wats. L. 310. New Braunfels. July 1850.

835. D. LACINIATA Wats. L. 310a. New Braunfels. July? 1850.

836. ERYNGIUM LEAVENWORTHII T. & G. L. 103. (Comanche Spring. July 1849). (403).

837. E. LEAVENWORTHII T. & G. L. 451. New Braunfels. Aug. 1850.

838. HYDROCOTYLE ASIATICA L. L. 630. New Braunfels. Aug. 1851. (613).

839. H. UMBELLATA L. L. 568. (New Braunfels). May 1851. (p. 209).

Plants mostly 3 dm. high and leaves 6 cm. in diameter.

840. CORNUS ASPERIFOLIA Michx. L. 318. New Braunfels. April 1850.

841. C. ASPERIFOLIA Michx. L. 318a. New Braunfels. (Aug.?) 1850.

842. GARRYA LINDHEIMERI Torr. L. 27. Comanche Spring. May 1849. (III–536).

843. G. LINDHEIMERI Torr. L. 512. (New Braunfels. July 1851).

844. G. LINDHEIMERI Torr. L. 27. (Comanche Spring. May 1849?).

845. LONICERA ALBIFLORA T. & G. L. 9. 20 mi. N. of San Antonio. April 1849.

846. SYMPHORICARPOS SPICATUS Engelm. L. 205. New Braunfels. Nov. 1849.

The type collection; Pl. Lind. 2:215.

847. S. SPICATUS Engelm. L. 320. New Braunfels. July 1850. Type locality.

848. VIBURNUM RUFOTOMENTOSUM Small. L. 507. New Braunfels. March 1851.

849. CRUSEA TRICOCCA Heller. L. 595. New Braunfels. (June 1851). (247).

850. VALERIANELLA AMARELLA Krok. L. 12. Comanche Spring. May 1849.

The type collection; Pl. Lind. 2:217, n. *Fedia amarella* Lindh.

851. V. AMARELLA Krok. L. 12a. (Comanche Spring. July?) 1849.

Apparently a co-type.

852. V. STENOCARPA Krok. L. 513. New Braunfels. March 1851. (407).

Type locality.

853. ACTINELLA LINEARIFOLIA T. & G. L. 39. Comanche Spring. June 1849. (267, 648).

854. AMBLYOLEPIS SETIGERA DC. L. 302. New Braunfels. May 1850.

"Muskit prairies, 12 mi. S. W. of New Braunfels."—Pl. Wright. 1:121.

855. AMBROSIA APTERA DC. L. 109. Comanche Spring. Aug. 1849. (428).

856. A. APTERA DC. L. 533? New Braunfels. July 1851?

857. A. APTERA DC. L. 484. (New Braunfels). Nov. 1850.

858. A. ARTEMISIAEFOLIA L. var. PANICULATA (Michx.). L. 171. Comanche Spring. Oct. 1849. *A. paniculata* Michx. Fl. **2**: 183.

A very slender, smoothish, widely branching form with leaves less divided than in *A. artemisiaefolia* L., the segments oblong-lanceolate to linear: sterile racemes loosely flowered and heads small (2 mm.): fruit small, with inconspicuous lateral tubercles. A well-marked variety approaching *A. glandulosa* Scheele. Linn. **22**: 157.

859. A. ARTEMISIAEFOLIA L. var. PANICULATA (Michx.) L. 502. (New Braunfels). Sept. 1850.

860. A. PSILOSTACHYA DC. L. 145. San Antonio. Sept. 1849.

An unusually large coarse form, 6-9 dm. high, with strigose pubescent leaves and segments relatively few and long lanceolate-acuminate; sterile racemes elongated and heads about 3 mm. diameter.

861. A. PSILOSTACHYA DC. var. LINDHEIMERIANA (Scheele). L. 390. New Braunfels. Sept. 1850. (429). *A. Lindheimeriana* Scheele. Linn. **22**: 156. *A. coronopifolia* T. & G. var. Gray, Pl. Lind. 2:226.

Leaves in these specimens vary considerably in pubescence and dissection. A well-marked variety.

862. AMPHIACHYRIS DRACUNCULOIDES Nutt. L. 474. (New Braunfels). Oct. 1850. (422).

863. APHANOSTEPHUS RAMOSISSIMUS DC. L. 233. (New Braunfels). July 1850. (414).

864. A. SKIRROBASIS Trelease. L. 254. (New Braunfels). May 1850. (111).

865. A. SKIRROBASIS Trelease. L. 549. (New Braunfels). May 1851.

866. APOGON GRACILIS DC. L. 420. (New Braunfels). April 1850. (447).
867. A. GRACILIS DC. L. 411. New Braunfels. May 1850.
868. ARTEMISIA CAUDATA Michx. L. 180. Comanche Spring. Oct. 1849. (p. 231).
869. A. DRACUNCULOIDES Pursh. L. 477. (New Braunfels). Oct. 1850. (440, 441).
870. A. GNAPHALODES Nutt. L. 478. (New Braunfels). Oct. 1850.
871. A. MEXICANA Willd. L. 472. (New Braunfels). Oct. 1850. (444, 447).
872. ASTER DRUMMONDII Lindl. L. 185. (Comanche Spring). Oct. 1849. (249).
873. A. DUMOSUS L. L. 209. Comanche Spring. Oct. 1849.
874. A. EXILIS Ell. L. 153. Comanche Spring. Oct. 1849. (p. 219).
875. A. EXILIS Ell. L. 388. New Braunfels. Sept. 1850.
876. A. MULTIFLORUS Ait. L. 190. San Antonio. Oct. 1849. (p. 219).

A glabrate form, varying to densely pubescent in the different specimens and with heads more scattered as if tending toward *A. vimineus* Lam.

877. A. OBLONGIFOLIUS Nutt. L. 187. Comanche Spring. Nov. 1849.
878. A. OBLONGIFOLIUS Nutt. L. 208. New Braunfels. (Nov.) 1849.
879. A. PANICULATUS Lam. var. SIMPLEX Burgess. L. 214. (New Braunfels). Nov. 1849. *A. simplex* Willd.
880. A. PANICULATUS Lam. L. 538. (New Braunfels). 1851.
881. A. SALICIFOLIUS Lam. L. 207. New Braunfels. (Nov.) 1849. (p. 219).
882. A. SALICIFOLIUS Lam. L. 186. Comanche Spring. Nov. 1849.
883. A. SALICIFOLIUS Lam. var. CANESCENS Gray. L. 536. (New Braunfels. April) 1851.
884. A. SERICEUS Vent. L. 188. Comanche Spring. Oct. 1849. (p. 219).
885. BACCHARIS ANGUSTIFOLIA Michx. L. 168. (Comanche Spring). Sept. 1849.

886. BERLANDIERA TEXANA DC. L. 249. New Braunfels. June 1850. (424).

887. BIDENS LAEVIS BSP. L. 483. New Braunfels. Oct. 1850. (435).

888. B. FRONDOSA L. L. 9. (Comanche Spring. May 1849).

889. BRICKELLIA CYLINDRACEA Gray & Engelm. L. 182. Comanche Spring. Oct. 1849. (412). Near the type locality.

890. B. RIDDELLII Gray. L. 181. Comanche Spring. Oct. 1849. (409).

This should probably be *B. dentata* (DC.), as the fact that *Clavigera dentata* DC., Prod. **5**: 128, is a form variant from the normal is no ground for giving the species a new name. See Pl. Wright. 1:83.

891. B. RIDDELLII Gray. L. 467. New Braunfels. Sept. 1850.

892. CENTAUREA AMERICANA Nutt. L. 34. Comanche Spring. May 1849. (114).

893. CHRYSACTINIA MEXICANA Gray. L. 77. Comanche Spring. June 1849.

894. CHRYSOPSIS VILLOSA Nutt. var. CANESCENS Gray. L. 356. New Braunfels. July 1850. (419). *C. Berlandieri* Greene.

895. CNICUS ALTISSIMUS Willd. var. FILIPENDULUS Gray. L. 33. San Antonio. May 1849. Near the type locality.

It is doubtful if this variety be more than a small, shaded form of *C. discolor* Muhl. with tuberous roots.

896. C. UNDULATUS Gray var. MEGACEPHALUS Gray. L. 46. Salado River. May 1849.

The collection varies considerably as to size of head and leaf dissection.

897. COREOPSIS CARDAMINEFOLIA T. & G. L. 548. New Braunfels. May 1851.

898. ECHINACEA ANGUSTIFOLIA DC. L. 29. (Comanche Spring). May 1849.

899. ELEPHANTOPUS CAROLINIANUS Willd. (No data).

900. ENCELIA CALVA Gray. L. 136. Comanche Spring. June 1849. (433).

901. ENGELMANNIA PINNATIFIDA T. & G. L. 522. New Braunfels. April 1851. (425, 639).

902. ERIGERON MODESTUS Gray. L. 40. (Comanche Spring). June 1849. (627).

The present collection seems undoubtedly perennial, not annual as stated in the Syn. Fl. **1²**: 218.

903. E. PHILADELPHICUS L. L. 496. New Braunfels. March 1850.

904. E. QUERCIFOLIUS Lam. L. 326. New Braunfels. May 1850.

905. E. TENUIS T. & G. L. 346. New Braunfels. April 1850.

906. EUPATORIUM AGERATIFOLIUM DC. var. TEXENSE T. & G. L. 201. New Braunfels. Nov. 1849. (413).

If priority of pagination be followed, this should be *E. Berlandieri texense* (T. & G.).

907. E. AGERATIFOLIUM DC. var. TEXENSE T. & G. L. 481. New Braunfels. Oct. 1850.

908. E. AGERATOIDES L. f. var. ANGUSTATUM Gray. L. 503. (New Braunfels. Sept. 1850).

Some of the specimens approach the type of the species.

909. E. AGERATOIDES L. f. L. 639. Comanche Spring. 1850.

A form approaching *E. incarnatum* Walt. in its marked pubescence, thin, subcordate leaves and subpubescent akenes.

910. E. COELESTINUM L. L. 492. New Braunfels. Oct. 1850.

911. E. SEROTINUM Michx. L. 378. Guadalupe River. Aug. 1850. (p. 219).

912. EVAX PROLIFERA Nutt. L. 543. (New Braunfels). May 1851. (633).

913. FRANSERIA TENUIFOLIA Gray. L. 475. (New Braunfels). Oct. 1850.

914. F. TENUIFOLIA Gray. L. 471. New Braunfels. Oct. 1850. (640?).

915. F. TENUIFOLIA Gray. L. 485. (Comanche Spring). Nov. 1850.

916. GAILLARDIA PULCHELLA Foug. L. 14. (Comanche Spring). May 1849.

A form with leaves almost wholly entire.

917. G. PULCHELLA Foug. L. 329. (New Braunfels). July 1850.

Leaves entire throughout.

918. G. SUAVIS Britt. & Rusby. L. 11. Comanche Spring. May 1849. (437, 646).

919. GRINDELIA INULOIDES Willd. L. 602. New Braunfels. July 1851. (255).

920. G. SQUARROSA Dunal. L. 83. Comanche Spring. July 1849. (418).

921. GUTIERREZIA TEXANA T. & G. L. 189. (Comanche Spring. Nov. 1849).

922. GYMNOSPERMA CORYMBOSUM DC. L. 179. Comanche Spring. Oct. 1849.

923. HELIANTHUS ANNUUS L. L. 320. New Braunfels. June 1850. (259). Form *H. lenticularis* Dougl.

It is questionable whether this huge Texas sunflower which grows high enough to conceal a train of covered wagons in the bottoms should be considered the same as the small northern species of Montana and Alberta, with smaller flowers and leaves, and which in the most favorable situations rarely becomes more than 12 or 15 dm. high.

924. H. ANNUUS L. L. 512. (New Braunfels). July 1851.

925. H. MAXIMILIANI Schrad. L. 157. (Comanche Spring). Oct. 1849. (260).

926. HETEROTHECA SUBAXILLARIS Britt. & Rusby. L. 392. New Braunfels. Aug. 1852. (88).

927. HYMENATHERUM PENTACHAETUM DC. L. 38. Comanche Spring. June 1849.

928. H. TAGETOIDES Gray. L. 59. Comanche Spring. June 1849. (265).

929. HYMENOPAPPUS CORYMBOSUS T. & G. L. 327. New Braunfels. May 1850. (438).

930. IVA ANGUSTIFOLIA Nutt. L. 183. (Comanche Spring). Oct. 1849. (427).

931. I. CILIATA Willd. L. 386. New Braunfels. Sept. 1850.

932. KEERLIA BELLIDIFOLIA Gray & Engelm. L. 279. New Braunfels. April 1850. (415, 628). Type locality; Proc. Amer. Acad. **1**: 47.

933. K. EFFUSA Gray. L. 141. (Comanche Spring). 1849. (629).

Probably the type locality.

934. KUHNIA GLUTINOSA Ell. L. 146. Comanche Spring. 1849. (410).

935. K. ROSMARINIFOLIA Vent. var. GRACILLIMA (Gray). L. 177. Cibolo River. Oct. 1849. (411). *K. eupatorioides gracillima* Gray. Pl. Lind. 2 : 218.

Type locality apparently.

936. LACTUCA FLORIDANA Gaertn. L. 377. New Braunfels. Aug. 1860.

937. LAPHAMIA LINDHEIMERI Gray. L. 314. New Braunfels. May 1850.

"Perpendicular rocks on the banks of the Guadalupe River near New Braunfels exposed to the full glare of the sun." Pl. Wright. 1 : 101. Type collection.

938. LEPACHYS COLUMNARIS T. & G. L. 234. (New Braunfels. Aug. 1850).

939. L. COLUMNARIS T. & G. var. PULCHERRIMA T. & G. L. 234a. (New Braunfels). Aug. 1850. (642).

940. LIATRIS ACIDOTA Engelm. & Gray var. MUCRONATA Gray. L. 155. Comanche Spring. Sept. 1849. (p. 10).

941. L. ACIDOTA Engelm. & Gray var. MUCRONATA Gray. L. 468. New Braunfels. Sept. 1850.

Many of these specimens seem near *L. punctata* Hook.

942. L. PUNCTATA Hook. L. 170. (Comanche Spring. Sept. 1849). (218).

943. L. PUNCTATA Hook. L. 372. New Braunfels. Sept. 1850.

944. LINDHEIMERA TEXANA Gray & Engelm. L. 71. Comanche Spring. May 1849. (424, 638).

An old mature form.

945. L. TEXANA Gray & Engelm. L. 423. New Braunfels. March 1850.

Type locality. Mainly young plants.

946. L. TEXANA Gray & Engelm. L. 554. New Braunfels. March 1850. Type locality.

947. LYGODESMIA APHYLLA DC. var. TEXANA T. & G. L. 32. (Comanche Spring. June 1849). (270, 651).

948. MARSHALLIA CAESPITOSA Nutt. L. 287. New Braunfels. May 1850. (110, 647).

949. MELAMPODIUM CINEREUM DC. L. 1. Comanche Spring. March 1849. (636).

950. MIKANIA SCANDENS Willd. L. 385. New Braunfels. Sept. 1850. (77).

951. PARTHENIUM HYSTEROPHORUS L. L. 309. New Braunfels. July 1850. (426).

952. PINAROPAPPUS ROSEUS Less. L. 359. New Braunfels. April 1850. (448, 650).

953. PLUCHEA PURPURASCENS DC. L. 453. (New Braunfels). Aug. 1850.

954. POLYMNIA UVEDALIA L. L. 381. New Braunfels. Aug. 1850. (637).

955. POLYPTERIS CALLOSA Gray. L. 535. New Braunfels. (April) 1850.

956. P. CALLOSA Gray. L. 188. Comanche Spring. Nov. 1849.

Form near *Othake roseum* Bush, Trans. St. L. Acad. Sci. **14**: 175.

957. SCLEROCARPUS MAJOR Small. L. 247. (New Braunfels. July 1850). (432).

958. SENECIO OBOVATUS Muhl. var. ROTUNDUS Britt. L. 441. New Braunfels. March 1850.

959. S. OBOVATUS Muhl. var. ROTUNDUS Britt. L. 510. New Braunfels. March 1851.

960. S. OBOVATUS Muhl. var. ROTUNDUS Britt. L. 510a. New Braunfels. March 1851.

961. SILPHIUM ASPERRIMUM Hook. L. 510b. (New Braunfels. March 1851).

962. S. SCABERRIMUM Ell. L. 37. Comanche Spring. May 1849. (257).

963. SOLIDAGO CANADENSIS L. var. CANESCENS Gray. L. 153. Comanche Spring. Oct. 1849.

Upper surface of the leaves somewhat too scabrous for the typical form of the variety.

964. S. CANADENSIS L. var. SCABRA T. & G. L. 479. (New Braunfels). Oct. 1850.

Varying nearly to the typical form of the species in some specimens.

965. S. NEMORALIS Ait. L. 156. Comanche Spring. Oct. 1849. (p. 223).

966. S. RADULA Nutt. L. 152. Comanche Spring. Oct. 1849. (p. 223).

967. S. RADULA Nutt. var. ROTUNDIFOLIA (DC.). L. 391. New Braunfels. Sept. 1850. *S. rotundifolia* DC.; *S. scaberrima* T. & G.

Tall plants with the leaves on the flowering branches greatly reduced.

968. S. SPECIOSA Nutt. var. RIGIDIUSCULA T. & G. L. 178. (Comanche Spring). Oct. 1849. (417).

969. TETRAGONOTHECA TEXANA Gray & Engelm. L. 544. (New Braunfels). Oct. 1851. (258, 431).

970. THELESPERMA SIMPLICIFOLIUM Gray. L. 580. (New Braunfels. May 1851). *T. subsimplicifolium* Gray.

971. VERNONIA INTERIOR Small. L. 393. New Braunfels. Aug. 1850.

972. V. LINDHEIMERI Gray. L. 127. Comanche Spring. July 1849. (408).

Fairly representative of the type.

973. VIGUIERA HELIANTHOIDES HBK. L. 184? Comanche Spring. Oct. 1849. (434).

974. V. HELIANTHOIDES HBK. L. 476. (New Braunfels). Oct. 1850.

975. ZEXMENIA HISPIDA Gray. L. 137. Comanche Spring. July 1849. (436).

976. Z. HISPIDA Gray. L. 321. (New Braunfels. July 1850).

977. Z. HISPIDA Gray. L. 509. (New Braunfels). June 1851.

978. LOBELIA SPLENDENS Willd. L. 466. (New Braunfels). Sept. 1850. (III-449).

979. BUMELIA LANUGINOSA Pers. L. 269. New Braunfels. July 1850.

980. DIOSPYROS TEXANA Scheele. L. 527. New Braunfels. March 1851. (III-451, 452, 453).

Type locality; Linn. **22**: 146.

981. FORESTIERA PUBESCENS Nutt. L. 501. (New Braunfels). Feb. 1850. (IV-700; III-537).

982. FRAXINUS AMERICANA L. var. TEXENSIS Gray. L. 240. (New Braunfels). May 1850.

983. MENODORA LONGIFLORA Gray. L. 111. (Comanche Spring). July 1849. (IV-652).

984. MACROSIPHONIA BERLANDIERI Gray. L. 128. Comanche Spring. June 1849.

985. ACERATES AURICULATA Engelm. L. 122. Comanche Spring. July 1849.

986. A. VIRIDIFLORA Ell. L. 633. New Braunfels. July 1851. (III-457).

987. ASCLEPIAS LINEARIS Scheele. L. 631. New Braunfels. June 1851. (III-456).

Type locality; Linn. **21**: 758.

988. A. TEXANA Heller. L. 52. Comanche Spring. June 1849. (IV-655).

Leaves very variable in size and texture.

989. ASCLEPIODORA DECUMBENS Gray. L. 280. New Braunfels. April 1850. (IV-653b).

GONOLOBUS LAEVIS Michx. New Braunfels. June 1851.

990. G. RETICULATUS Engelm. L. 545. New Braunfels. (June) 1851. (III-461).

One of the localities mentioned by Torrey in his description of *G. granulatus* in Mex. Bound. Surv. **2**: 165.

991. METASTELMA BARBIGERUM Scheele. L. 235. New Braunfels. June 1850. (III-459).

Type locality.

992. M. BARBIGERUM Scheele. L. 511. (New Braunfels). July 1851.

993. PHILIBERTIA CYNANCHOIDES Gray. L. 349. New Braunfels. Aug. 1850.

994. P. CYNANCHOIDES Gray. L. 628. New Braunfels. Aug. 1851.

P. CRISPA Hemsl. New Braunfels. 1851.

995. ROULINIA UNIFARIA Engelm. L. 333. (New Braunfels. June 1850). (III-460).

Type locality: "Upper Guadalupe not far from New Braunfels;" Linn. **21**: 760.

996. R. UNIFARIA Engelm. L. 454. New Braunfels. June 1851.

997. R. UNIFARIA Engelm. L. 623. (New Braunfels. Aug. 1851).

998. BUDDLEIA RACEMOSA Torr. L. 124. (Comanche Spring). July 1849. (III-485).

The leaves larger (3.5×6 cm.), glabrous and white pulverulent beneath, and panicled racemes more lax than in the normal of the species.

999. B. RACEMOSA Torr. L. 345. New Braunfels. June 1850. (III-485).

Heads either sessile or on peduncles up to 1.5 cm. long; leaves small and narrow (1×3.5 cm.), white pulverulent beneath.

1000. MITREOLA PETIOLATA T. & G. L. 150. (Comanche Spring. Aug.) 1849. (67).

1001. ERYTHRAEA BEYRICHII T. & G. L. 63. Comanche Spring. June 1849. (III-464).

1002. E. TEXENSIS Griseb. L. 56. Comanche Spring. May 1849. (III-463).

1003. EUSTOMA RUSSELLIANUM Griseb. L. 231. New Braunfels. June 1850. (274).

1004. GILIA INCISA Benth. L. 271. New Braunfels. June 1850. (III-466).

1005. G. RIGIDULA Benth. L. 490. New Braunfels. April 1850. (III-465).

1006. G. RUBRA Heller. L. 32. Comanche Spring. June 1849. (122).

1007. PHLOX PILOSA L. L. 7. San Antonio. April 1849.

A small form less than 3 dm. high. This small, densely glandular or viscid pubescent form with wider leaves and shorter corolla tube, extending from Missouri to Texas, should probably be separated as a variety at the opposite extreme from var. *detonsa*, (as var. *texana*).

1008. P. ROEMERIANA Scheele. L. 316. New Braunfels. April 1850. (III-467).

Type locality; Linn. **21 : 752.**

1009. NAMA HISPIDUM Gray. L. 267. New Braunfels. May 1850. (130).

1010. N. JAMAICENSE L. L. 213. (New Braunfels. Nov.) 1849. (III-476).

1011. N. JAMAICENSE L. L. 542. New Braunfels. Nov. 1851.

1012. NEMOPHILA PHACELIOIDES Nutt. L. 521. New Braunfels. March 1851. (IV-666).

1013. PHACELIA CONGESTA Hook. L. 342. New Braunfels. May 1850. (III-478).

1014. P. CONGESTA Hook. L. 536. New Braunfels. April 1851.

1015. EHRETIA ELLIPTICA DC. L. 416. (New Braunfels). March 1850. (IV-665).

1016. E. ELLIPTICA DC. (New Braunfels). June 1850.

Leaves pustulate scabrous.

1017. E. ELLIPTICA DC. L.591. (New Braunfels). June 1851.

1018. HELIOTROPIUM INUNDATUM Swartz. L. 614. (New Braunfels). Aug. 1851. (133).

1019. H. TENELLUM Torr. (No data). (131).

1020. LITHOSPERMUM ANGUSTIFOLIUM Michx. L. 410. (New Braunfels). July 1850.

1021. L. BREVIFLORUM Engelm. & Gray. (New Braunfels). 1851. (278).

1022. ONOSMODIUM BEJARIENSE DC. Comanche Spring. May 1849.

1023. O. BEJARIENSE DC. L. 274. New Braunfels. May 1850.

1024. O. BEJARIENSE DC. L. 518. New Braunfels. March 1851.

1025. O. HELLERI Small. L. 15. Comanche Spring. May 1849.

1026. O. HELLERI Small. L. 117. (Comanche Spring. July 1849).

1027. CONVOLVULUS INCANUS Vahl. L. 290. New Braunfels. July 1850. (p. 44, n.; III-470).
CUSCUTA PULCHERRIMA Scheele. (New Braunfels). 1851. (III-475).

1028. C. GLOMERATA Choisy. L. 106. Comanche Spring. Aug. 1849.
On *Helianthus Maximiliani* Schrader.

1029. C. HISPIDULA Engelm. L. 31. Comanche Spring. June 1849. (III-474).

1030. DICHONDRA REPENS Forst. L. 438. New Braunfels. March 1850. (IV-663).

1031. IPOMOEA LINDHEIMERI Gray. L. 622. New Braunfels. Aug. 1851.

1032. I. TRIFIDA Don var. TORREYANA Gray. L. 190. 20 mi. N. of San Antonio. Sept. 1849.

1033. I. TRIFIDA Don var. TORREYANA Gray. L. 305. Comanche Spring. June 1850.

1034. BOUCHETIA ANOMALA Britt. & Rusby. L. 189. Comanche Spring. Oct. 1849. (III-471).

1035. B. ANOMALA Britt. & Rusby. L. 346. New Braunfels. June 1850.

1036. CAPSICUM BACCATUM L. L. 358. New Braunfels. July 1850. (III-482).

1037. CHAMAESARACA CONIOIDES Britt. L. 532. San Antonio. June 1851. (III-484b mainly).

1038. C. CORONOPUS Gray. L. 268. New Braunfels. May 1850. (IV-668; III-484).

1039. NICOTIANA REPANDA Willd. L. 565. New Braunfels. May 1851. (III-483).

1040. N. TRIGONOPHYLLA Dunal. L. 300. (New Braunfels). May 1850.

1041. SOLANUM ELAEAGNIFOLIUM Cav. L. 328. (New Braunfels). June 1850. (135; IV-667).

1042. S. ROSTRATUM Dunal. L. 352. New Braunfels. July 1850. (III-480).

1043. S. TORREYI Gray. L. 282. (New Braunfels). May 1850. (281).

1044. S. TRIQUETRUM Cav. 525. New Braunfels. 1851. (III-481).

Form with large cordate leaves.

1045. S. TRIQUETRUM Cav. var. LINDHEIMERIANUM Gray. L. 422. New Braunfels. June 1850. (III-481).

Form with smaller leaves with more or less basal lobing; *S. Lindheimerianum* Scheele; Linn. **21**: 766.

1046. ANTIRRHINUM ANTIRRHINIFLORUM Small. L. 147. Comanche Spring. 1849. (III-487).

1047. CASTILLEIA INDIVISA Engelm. L. 292. (New Braunfels). April 1850. (284).

1048. CONOBEA MULTIFIDA Benth. L. 118. Comanche Spring. Aug. 1849. (138).

1049. C. MULTIFIDA Benth. L. 619. New Braunfels. Aug. 1851.

1050. GERARDIA ASPERA Dougl. L. 151. 40 mi. N. of San Antonio. Sept. 1849.

1051. G. DENSIFLORA Benth. L. 112. (Comanche Spring. July 1849).

1052. G. DENSIFLORA Benth. L. 379. New Braunfels. Aug. 1850.

1053. G. STRICTIFLORA Benth. L. 149. (Comanche Spring. Aug. 1849).

1054. HERPESTIS CHAMAEDRYOIDES HBK. L.75. Comanche Spring. July 1849. (III-486).

1055. H. CHAMAEDRYOIDES HBK. L. 616. New Braunfels. 1851.

1056. H. MONNIERA HBK. L. 621. New Braunfels. July 1851. (137).

1057. MIMULUS GLABRATUS HBK. L. 517. New Braunfels. Aug. 1851. (IV-671).

1058. SEYMERIA BIPINNATISECTA Seem. var. TEXANA Gray. L. 113. (Comanche Spring. July 1849). (IV-670).

1059. S. BIPINNATISECTA SEEM. var. TEXANA Gray. L. 148. Comanche Spring. Aug. 1849.

1060. VERONICA PEREGRINA L. L. 535. New Braunfels. March 1851.

1061. DIANTHERA AMERICANA L. L. 64. Comanche Spring. June 1849. (291).

1062. DICLIPTERA BRACHIATA Spreng. New Braunfels. 1850. (160).

The pubescent form.

1063. CALOPHANES LINEARIS Gray. L. 552. New Braunfels. May 1851. (III-504; IV-677).

1064. RUELLIA DRUMMONDIANA Gray. L. 351. New Braunfels. Aug. 1850. (III-506).

1065. R. PARRYI Gray. L. 396. New Braunfels. Aug. 1851.

1066. R. TUBEROSA L. L. 319. New Braunfels. July 1851. (157).

SIPHONOGLOSSA PILOSELLA Torr. New Braunfels. 1851. (III-505). Shady woods.

1067. CALLICARPA AMERICANA L. L. 297. New Braunfels. July 1850.

1068. LANTANA HORRIDA HBK. L.334. New Braunfels. May 1850. (III-503).

1069. LIPPIA CUNEIFOLIA Steud. var. INCISA (Small). L. 262. New Braunfels. July 1850. *Phyla incisa* Small.

1070. L. LIGUSTRINA Britton. L. 275. (New Braunfels). May 1850. (III-502).

1071. L. NODIFLORA Michx. L. 288. New Braunfels. May 1850. (156; IV-676).

1072. VERBENA BIPINNATIFIDA Nutt. L. 232. (New Braunfels). June 1850. (289).

1073. V. BIPINNATIFIDA Nutt. L. 10. (Comanche Spring. April 1849).

1074. V. CANESCENS HBK. L.294. New Braunfels. April 1850. (III-500).

1075. V. CILIATA Benth. L. 434. New Braunfels. March 1850. (III-501).

1076. V. OFFICINALIS L. L. 537. New Braunfels. April 1851. (155).

1077. V. URTICAEFOLIA L. L. 618. (New Braunfels). July 1851.

1078. BRAZORIA SCUTELLARIOIDES Engelm. & Gray. L. 55. (Comanche Spring). May 1849. (286).

Numbers 286 and 287 of Pl. Lind. 1:48 and 49, were accidentally transposed in the printing, thus differing from the exsiccatae issued.

1079. B. SCUTELLARIOIDES Engelm. & Gray. L. 553. (New Braunfels. May) 1851.

1080. HEDEOMA ACINOIDES Scheele. L. 264. New Braunfels. April 1850. (III-496).

1081. H. REVERCHONI Gray. L. 81. Comanche Spring. July 1849. (III-495).

1082. H. REVERCHONI Gray. L. 284? (New Braunfels). May 1850.

1083. MONARDA CITRIODORA Cerv. L. 35. Comanche Spring. June 1849. (153; III-497).

1084. M. PUNCTATA L. L. 250. New Braunfels. June 1850. (152).

1085. SALVIA AZUREA Lam. L. 114. Comanche Spring. Aug. 1849. (145).

1086. S. BALLOTAEFLORA Benth. L. 18. Comanche Spring. April 1849.

1087. S. BALLOTAEFLORA Benth. (No data).

1088. S. ENGELMANNI Gray. L. 276. New Braunfels. May 1850.

Rather hirsute, but otherwise fairly typical.

1089. S. ENGELMANNI Gray. L. 50. (Comanche Spring). June 1849.

Puberulent throughout; leaves unusually wide, ovate-elliptical to linear above: calyx somewhat hirsute.

1090. S. FARINACEA Benth. L. 204. New Braunfels. Nov. 1849. (III-498; IV-672).

1091. S. FARINACEA Benth. L. 564. (New Braunfels). May 1851.

1092. S. PENTSTEMONOIDES Kunth. L. 66. San Antonio. June 1849. (IV-673).

1093. S. ROEMERIANA Scheele. L. 255. New Braunfels. May 1850. (III-499).

Type locality; Linn. **22** : 586.

1094. S. TEXANA Torr. L. 561. New Braunfels. April 1851. (III-493, 494).

A widely branching, broad-leaved form.

1095. SCUTELLARIA DRUMMONDII Benth. L. 265. New Braunfels. June 1850. (143).

1096. STACHYS AGRARIA Cham. & Schlecht. L. 574. (New Braunfels). March 1851.

1097. TEUCRIUM LACINIATUM Torr. L. 23. Comanche Spring. May 1849. (IV-675).

1098. PLANTAGO HELLERI Small. L. 556. New Braunfels. May 1851.

1099. P. OCCIDENTALIS Decne. L. 534. New Braunfels. April 1851.

1100. P. WRIGHTIANA Decne. (New Braunfels). 1850. (III-511).

1101. BOERHAVIA LINEARIFOLIA Gray. L. 289. (New Braunfels). June 1850. (III-510).

1102. B. LINEARIFOLIA Gray. L. 584. (New Braunfels. May) 1851.

1103. MIRABILIS JALAPA L. L. 567. (New Braunfels). May 1851. (III-507).

1104. PARONYCHIA DICHOTOMA Nutt. L. 173. (Comanche Spring). Sept. 1849. (222).

1105. P. LINDHEIMERI Engelm. L. 144. (Comanche Spring). Sept. 1849. (335).

1106. ACNIDA TAMARISCINA Wood. L. 142. (Comanche Spring). Sept. 1849.

1107. ALTERNANTHERA REPENS Kuntze. L. 202. (New Braunfels). Nov. 1849. (III-512).

1108. A. REPENS Kuntze. L. 353. (New Braunfels). July 1850.

1109. AMARANTHUS SPINOSUS L. L. 354. (New Braunfels). July 1850.

1110. IRESINE PANICULATA Kuntze. L. 500. (New Braunfels). Nov. 1850. (165; III-514).

1111. I. PANICULATA Kuntze. (No data).

1112. CHENOPODIUM BERLANDIERI Moq. L. 369. (New Braunfels). Aug. 1850.

1113. RIVINA PORTULACCOIDES Nutt. L. 374. (New Braunfels). Aug. 1850. (295).

This differs from *R. laevis* L. in its large (3-4 mm. long) sepals and its large (3-4 mm.), dry fruit. It is probable that Nuttall's species will stand on a closer study of this genus. See Trans. Am. Phil. Soc. **5**: 167.

1114. ERIOGONUM ANNUUM Nutt. L. 355. (New Braunfels). July 1850. (III-516).

1115. E. LONGIFOLIUM Nutt. L. 73. (Comanche Spring). July 1849. (IV-684).

1116. POLYGONUM HYDROPIPEROIDES Michx. L. 450. (New Braunfels). Sept. 1850.

1117. P. LAPATHIFOLIUM L. L. 376. (New Braunfels). Aug. 1850.

1118. P. RAMOSISSIMUM Michx. L. 196. (Comanche Spring). Sept. 1849.

1119. LINDERA BENZOIN Blume. L. 449. (New Braunfels). Jan. 1850. (III-517).

1120. PHORADENDRON FLAVESCENS Nutt. var. ORBICULATUM Engelm. L. 115. (Comanche Spring). June 1849. (p. 212).

1121. P. FLAVESCENS Nutt. var. PUBESCENS Engelm. L. 227. (New Braunfels). Dec. 1849. (406). On *Ulmus*. Approximately the type locality.

1122. P. FLAVESCENS Nutt. var. PUBESCENS Engelm. L. 445. (New Braunfels). Jan. 1850.

1123. ANDRACHNE PHYLLANTHOIDES Coult. L. 47. (Comanche Spring). June 1849. (III-534).

1124. A. PHYLLANTHOIDES Coult. L. 48. (Comanche Spring). June 1849.

1125. A. PHYLLANTHOIDES Coult. var. REVERCHONI (Coult.)

L. 306. (New Braunfels). July 1850. *A. Reverchoni* Coult. Bot. West. Tex. 396.

Leaves of these specimens are somewhat smaller than those of Coulter's type. I doubt if this be more than a pubescent form of *A. phyllanthoides.*

1126. ARGITHAMNIA HUMILIS Muell. L. 197. (Comanche Spring). Oct. 1849. (306).

1127. A. MERCURIALINA Muell. L. 317. (New Braunfels). July 1850. (III-518).

Foliage nearly glabrous, turning reddish.

1128. BERNARDIA MYRICAEFOLIA Wats. L. 363. (New Braunfels). June 1850. (III-523, 524).

Apparently the type locality; Linn. **25**: 581.

1129. B. MYRICAEFOLIA Wats. L. 506. (New Braunfels). July 1851.

1130. CROTON FRUTICULOSUS Engelm. var. FRUTESCENS Muell. L. 134. (Comanche Spring). July 1849.

1131. C. FRUTICULOSUS Engelm. var. FRUTESCENS Muell. L. 498. (New Braunfels). Oct. 1850.

1132. C. TEXENSIS Muell. L. 251 & 252. (New Braunfels). June 1850. (305).

1133. JATROPHA TEXANA Muell. L. 371. (New Braunfels). Aug. 1850. (178).

1134. EUPHORBIA ANGUSTA Engelm. L. 123. (Comanche Spring). June 1849. (IV-694).

1135. E. ARKANSANA Engelm. & Gray. L. 28. (Comanche Spring). May 1849. (302).

1136. E. ARKANSANA Engelm. & Gray. L. 277. (New Braunfels). May 1850.

1137. E. FENDLERI T. & G. L. 62. (Comanche Spring). May 1849. (III-531). *E. rupicola* Scheele; Linn. **22**: 153.

1138. E. FENDLERI T. & G. L. 242. (New Braunfels). July 1850. (III-531).

1139. E. GLYPTOSPERMA Engelm. L. 243. (New Braunfels. July 1850).

1140. E. HETEROPHYLLA L. L. 541. (New Braunfels. April) 1851. (IV-696, 697).

1141. E. HETEROPHYLLA L. var. GRAMINIFOLIA Engelm. L. 140. (Comanche Spring). July 1849. Mex. Bound. Surv. **2**: 190.

1142. E. LONGICRURIS Scheele. L. 17. (Comanche Spring). March 1849. (III-529; IV-698).

1143. E. MACULATA L. L. 261. (New Braunfels). July 1850.

1144. E. MARGINATA Pursh. L. 133. (Comanche Spring). July 1849.

1145. E. MARGINATA Pursh. L. 395. (New Braunfels). Aug. 1850.

1146. E. NUTANS Lag. L. 493. (New Braunfels). Oct 1851. (IV-695).

1147. E. ROEMERIANA Scheele. L. 446. (New Braunfels). Feb. 1850. (III-528; IV-699).

1148. E. VILLIFERA Scheele. L. 308. (New Braunfels). July 1850. (III-530).

The type locality; Linn. **22**: 153.

1149. E. VILLIFERA Scheele. L. 508. (New Braunfels). Nov. 1851.

1150. E. ZYGOPHYLLOIDES Boiss. L. 246. (New Braunfels). July 1850.

1151. PHYLLANTHUS POLYGONOIDES Nutt. L. 49. (Comanche Spring). June 1849. (177).

1152. STILLINGIA ANGUSTIFOLIA Engelm. L. 61. (Comanche Spring. June 1849).

1153. S. ANGUSTIFOLIA Engelm. L. 244. (New Braunfels. July 1850). (III-519; IV-687). Proc. Am. Acad. **18**: 154. *S. sylvatica linearifolia* Muell. DC. Prod. **18²**: 1158. *S. linearifolia* (Muell.) Small, not Wats. Proc. Am. Acad. **14**: 297.

1154. TRAGIA NEPETAEFOLIA Cav. var. RAMOSA Muell. L. 139. (Comanche Spring). Aug. 1849. (307).

1155. T. NEPETAEFOLIA Cav. var. TEUCRIIFOLIA Muell. L. 138. (Comanche Spring). July 1849. (III-522). *T. teucriifolia* Scheele; Linn. **25**: 586.

Diffusely twining; leaves narrowly oblong-deltoid, cordate at base; staminate sepals 3, rarely 4.

1156. T. STYLARIS Muell. var. ANGUSTIFOLIA Muell. L. 74. (Comanche Spring). July 1849. (III-521).

1157. CELTIS BERLANDIERI Klotzsch. L. 444. New Braunfels. March 1850.

It seems necessary to retain *C. Berlandieri* Klotzsch (Linn. **20:** 541), with thick, ovate, entire or subentire leaves, passing into *C. mississippiensis* Bosc on the one hand and into *C. reticulata* Torr. on the other. *C. texana* Scheele (Linn. **22:** 146) is a form of *C. Berlandieri* with larger and more acuminate leaves. Apparently the stone of *C. Berlandieri* may be either smooth or reticulated. It is unquestionably distinct from *C. mississippiensis*, which is found in the bottoms of the large rivers, while *C. Berlandieri* occurs normally on high, dry knolls and uplands and rarely attains the dignity of a tree. It extends northeastward into southwest Missouri.

1158. C. BERLANDIERI Klotzsch. New Braunfels. (August) 1850.

Form with reticulate stone.

1159. C. BERLANDIERI Klotzsch. (New Braunfels. Aug. or Sept.) 1850.

Form with smooth stone.

1160. C. PALLIDA Torr. L. 363? (New Braunfels). April 1850.

1161. C. PALLIDA Torr. New Braunfels. 1851.

1162. C. PALLIDA Torr. L. 495. (New Braunfels). July 1850.

1163. C. PALLIDA Torr. L. 605. New Braunfels. July 1851.

1164. C. RETICULATA Torr. L. 341. New Braunfels. May 1850. Form *C. Helleri* Small.

1165. MORUS MICROPHYLLA Buckley. L. 24. (Comanche Spring). April 1849. (IV-701).

1166. M. MICROPHYLLA Buckl. (Comanche Spring). May 1849.

A form with thick, lobed leaves, very hispid on both surfaces.

1167. M. MICROPHYLLA Buckl. L. 440. (New Braunfels). March 1850.

1168. M. RUBRA L. L. 437. (New Braunfels). March 1850.

Ovate-leaved form.

1169. M. RUBRA L. 1850.

Ovate-leaved form.

1170. M. RUBRA L. (New Braunfels). 1850.

Form with lobed leaves.

1171. M. RUBRA L. (No data).

A form with small, mostly lobed leaves, apparently approaching *M. microphylla* Buckl.

1172. ULMUS ALATA Michx. L. 389. (New Braunfels). Sept. 1850.

1173. U. CRASSIFOLIA Nutt. L. 389a. (New Braunfels). Sept. 1850. (p. 54).

1174. URTICA CHAMAEDRYOIDES Pursh. L. 405. (New Braunfels). March 1850. (179; IV-702).

1175. PLATANUS OCCIDENTALIS L. L. 343. (New Braunfels). May 1850.

1176. P. OCCIDENTALIS L. (New Braunfels). 1850.

1177. CARYA PECAN (Marsh.). L. 563. (New Braunfels. April 1851). *Juglans Pecan* Marsh.

1178. JUGLANS RUPESTRIS Engelm. L. 20. (Comanche Spring). May 1849.

1179. J. RUPESTRIS Engelm. L. 519. (New Braunfels). April 1851.

1180. QUERCUS TEXANA Buckl. L. 437. (New Braunfels). 1850.

1181. Q. TEXANA Buckl. (New Braunfels). March 1850.

1182. Q. TEXANA Buckl. L. 504. (New Braunfels). Oct. 1850.

1183. Q. TEXANA Buckl. L. 511. New Braunfels. March 1851.

1184. Q. VIRGINIANA Mill. L. 488. (New Braunfels). March 1850. (180).

1185. Q. VIRGINIANA Mill. L. 489. (New Braunfels). April 1850.

1186. Q. VIRGINIANA Mill. L. 469. (New Braunfels). Oct. 1850.

1187. Q. VIRGINIANA Mill. L. 470. (New Braunfels). Oct. 1850.

1188. Q. VIRGINIANA Mill. New Braunfels. March 1851.
1189. SALIX HUMBOLDTIANA Willd. L. 415. Piedernales River. (March) 1850.

These specimens are identical with those of Berlandier (Nos. 2317, 2274 and 3026), collected in adjacent Mexico and enumerated by Andersson (Mon. Sal. 16) as of this species, though I do not find it heretofore reported from the United States. It appears to be confluent with *S. nigra* Marsh. in this region, from which it is easily distinguished by its narrower dull-surfaced leaves.

1190. S. THURBERI Rowlee. L. 515. (New Braunfels. Aug. 1851). Bull.-Torr. Bot, Club. **27**: 282.
1191. S. THURBERI Rowlee. L. 605. Dry bed of the Cibolo. Aug. 1851.
1192. EPHEDRA ANTISYPHILITICA Meyer. L. 428. Guadalupe River on rocks. March 1849.
1193. E. ANTISYPHILITICA Meyer. L. 273. Upper Guadalupe River on rocks. May 1850.
1194. JUNIPERUS SABINOIDES Sargent. L. 362b. New Braunfels. Feb. 1850. *J. occidentalis conjugens* Engelm.
1195. J. SABINOIDES Sarg. L. 362a. (New Braunfels). Feb. 1850.
1196. J. SABINOIDES Sarg. L. 228. New Braunfels. Feb. 1850.
1197. J. SABINOIDES Sarg. L. 228a. (New Braunfels). June 1850.
1198. TAXODIUM DISTICHUM Rich. L. 236. New Braunfels. July 1850. (181).
1199. SPIRANTHES CERNUA Rich. L. 203. (New Braunfels). Nov. 1849.
1200. TILLANDSIA RECURVATA L. L. 226. (New Braunfels). Dec. 1849. (III-539).
1201. T. RECURVATA L. L. 311. (New Braunfels). July 1850.
1202. T. USNEOIDES L. (New Braunfels). 1850.
1203. T. USNEOIDES L. L. 329. New Braunfels. Oct. (1850).

1204. HERBERTIA DRUMMONDIANA Herb. L. 325. (New Braunfels). April 1850.

1205. NEMASTYLIS ACUTA Herb. L. 562. (New Braunfels). April 1851. (IV-708).

1206. COOPERIA DRUMMONDII Herb. L. 107. (Comanche Spring). July 1849. (196; IV-707).

1207. ZEPHYRANTHES TEXANA Herb. L. 482. (New Braunfels). Oct. 1850. (314).

1208. ALLIUM MUTABILE Michx. L. 21. (Comanche Spring). April 1849. (199).

1209. A. NUTTALLII Wats. L. 528. New Braunfels. March, April 1851.

A co-type; Proc. Am. Acad. **14**: 227.

1210. CAMASSIA ANGUSTA (Engelm. & Gray). L. 532. (New Braunfels). April 1851. (198; III-541 in part). *C. Fraseri angusta* Torr.

If there be a difference in the time of blooming between this and *C. Fraseri* Torr., as stated in Pl. Lind. 1:29, the two are doubtless distinct species.

1211. DASYLIRION TEXANUM Scheele. L. 70a. Comanche Spring. June 1849. (III-548, 549).

1212. D. TEXANUM Scheele. L. 70b. Comanche Spring. June 1849.

1213. D. TEXANUM Scheele. L. 70c. Comanche Spring. June 1849.

1214. NOLINA LINDHEIMERIANA Wats. L. 45a. (Comanche Spring). May 1849. (III-551, 552).

1215. N. LINDHEIMERIANA Wats. L. 45c. (Comanche Spring). May 1849.

1216. N. LINDHEIMERIANA Wats. L. 45b. (Comanche Spring). May 1849.

1217. N. LINDHEIMERIANA Wats. L. 45d. (Comanche Spring). May 1849.

1218. N. TEXANA Wats. L. 2. (Comanche Spring. March 1849). (III-550; IV-712).

1219. NOTHOSCORDUM BIVALVE Britton. L. 524 (New Braunfels). April 1851.

1220. SCHOENOCAULON DRUMMONDII Gray. (New Braunfels). 1850. (III-543; IV-711).

1221. S. DRUMMONDII Gray. L. 555. (New Braunfels). May 1851.

1222. SMILAX BONA-NOX L. L. 457. (New Braunfels). March 1850.

1223. S. BONA-NOX L. L. 458. (New Braunfels). April 1850. *S. tamnoides* L.

1224. YUCCA ARKANSANA Trelease. New Braunfels. 1850. *Y. angustifolia mollis* Engelm.

1225. Y. RUPICOLA Scheele. L. 36. (Comanche Spring). June 1849. (IV-709). *Y. tortifolia* Lind.

1226. ZYGADENUS NUTTALLII Gray. L. 5. (Comanche Spring). March 1849.

1227. HETERANTHERA DUBIA MacM. L. 529. Guadalupe River at New Braunfels. Aug. 1851.

1228. H. LIMOSA Willd. L. 67. (Comanche Spring). June 1849.

1229. JUNCUS ACUMINATUS Michx.? Springs near New Braunfels. June 1850.

1230. PISTIA STRATIOTES L. L. 268. (New Braunfels). Oct. 1850.

1231. P. STRATIOTES L. L. 629. (New Braunfels). Aug. 1851.

1232. ECHINODORUS CORDIFOLIUS Griseb. L. 195. (Comanche Spring). Sept. 1849. (IV-714).

Small plants from 1-3 dm. high with leaves from narrowly lanceolate to ovate-cordate.

1233. E. CORDIFOLIUS Griseb. L. 373. (New Braunfels). Aug. 1850.

Small plants, rarely 2 dm. high.

1234. POTAMOGETON LONCHITES Tuckerm.? L. 116. (Comanche Spring). July 1849. (311).

Immature; leaf-blades and petioles unusually long.

1235. CYPERUS ACUMINATUS T. & G. L. 99. (Comanche Spring). July 1849.

Unusually tall plants, 3 dm. or more high.

1236. C. ARTICULATUS L. L. 594. (New Braunfels). June 1851.

1237. C. ESCULENTUS L. L. 96. (Comanche Spring). Aug. 1849.

1238. C. FILICULMIS Vahl. L. 98. (Comanche Spring). July 1849.

1239. C. INFLEXUS Muhl. L. 95. (Comanche Spring). Aug. 1849.

1240. DICROMENA COLORATA Hitchk. L. 143. (Comanche Spring). Sept. 1849. (IV-717).

1241. D. COLORATA Hitchk. L. 237. (New Braunfels). April 1850.

1242. D. NIVEA Boeckl. L. 93. (Comanche Spring). Aug. 1849. (IV-718).

ELEOCHARIS CELLULOSA Torr. New Braunfels. 1851. (IV-719).

1243. FIMBRISTYLIS SPADICEA Vahl. L. 94. (Comanche Spring). Aug. 1849.

1244. FUIRENA SIMPLEX Vahl. L. 206. (Comanche Spring). Aug. 1849. (III-557).

1245. HEMICARPHA DRUMMONDII Nees. L. 97. (Comanche Spring). July 1849. *H. micrantha* Britt. var. *aristulata* Coville. Torr. Bull. **21**: 36. *H. Drummondii* Nees. Mart. Fl. Bras. **2**[1]: 62. "Drummond, ad Castellum S. Louis: Drummond in Herb. Hook."

This probably came from Texas and not St. Louis, Mo., as the species is not known from the latter locality. There is nothing in the brief description of Nees to distinguish this from Coville's *H. micrantha aristulata* and it is probably a good species, distinguished from *H. micrantha* Britt. by its large size, 15-20 cm. high, marked acuminate scales and black akenes.

1246. ANDROPOGON FURCATUS Muhl. L. 159. Comanche Spring. Sept. 1849. (IV-741).

1247. A. SCOPARIUS Michx. L. 166. Comanche Spring. Sept. 1849.

1248. A. TORREYANUS Steud. L. 161. (Comanche Spring). Sept. 1849.

ARISTIDA PURPUREA Nutt. var. HOOKERI Trin. L. 87. Comanche Spring. 1849. —New Braunfels. 1849. *A. longiseta Hookeri* Merrill.

1249. BOUTELOUA CURTIPENDULA Torr. L. 357. (New Braunfels). July 1850. (III-568).

1250. B. HIRSUTA Lag. L. 89. Comanche Spring. Aug. 1849. (IV-731).

"Muskit grass." On rocky soil.

B. TEXANA Wats. (New Braunfels). 1851. (IV-732).

BUCHLOE DACTYLOIDES Engelm. L. 645. Cibolo River. May 1850. (III-569).

CHAETOCHLOA GLAUCA Scribn. New Braunfels. (Nov.) 1849.

1251. C. SETOSA Scribn. L. 164. Comanche Spring. Aug. 1849.

"In masses near thickets and on slopes."

Glabrous-leaved form; spikes varying from narrowly cylindrical to narrowly conical. Near *C. composita* Scribn., but most of the spikes narrower than in that species and longer and more acuminate than in *C. caudata*. It is probable that these related forms are all one species under varying conditions.

1252. CHRYSOPOGON AVENACEUS Benth. L. 167. (Comanche Spring). Sept. 1849. (211; IV-740).

1253. ELYMUS VIRGINICUS L. L. 570. New Braunfels. May 1851. (IV-739).

1254. E. VIRGINICUS L. L. 569. New Braunfels. May 1851.

A form differing from the normal of the species by its narrower empty glumes and elongated 4–5-flowered spikelets. Apparently approaching *E. striatus* Willd.

1255. EPICAMPES DISTICHOPHYLLA Vasey var. MUTICA Scribn. L. 176. (Comanche Spring). Oct. 1849. (IV-725).

Close to *E. ligulata* Scribn., but differs in its narrow conduplicate leaf with short (6 mm.) ligule.

1256. ERIOCHLOA SERICEA Munro. L. 290. (New Braunfels. 1850). (III-566).

1257. E. SERICEA Munro. L. 165. (Comanche Spring). Aug. 1849. (III-566).

1258. FESTUCA VERSUTA Beal. L. 91. Comanche Spring. June 1849. *F. texana* Vasey.

"On rocky soil under trees." Occasionally with proliferous spikelets.

1259. HILARIA TEXANA Nash. L. 92. (Comanche Spring). Aug. 1849.

1260. LEPTOCHLOA MUCRONATA Kunth. L. 84. (Comanche Spring). June 1849. (212).

1261. MELICA DIFFUSA Pursh. L. 85. (Comanche Spring. June 1849). (IV-729).

1262. MUHLENBERGIA REVERCHONI Vasey & Scribn. L. 88. (Comanche Spring). Aug. 1849.

Differs from the Reverchon type in its more strongly convolute, curved, filiform leaves and shorter (1 mm.) awn of the flowering glume. The panicle and spikelets seem normally purplish in both and the long tapering spikelet is characteristic. It differs from *M. trichopodes* Chapm. in its shorter, narrow, appressed panicle, its shorter, involute, filiform curved leaves and smaller size; the spikelets also are longer and more acuminate and the awn shorter.

1263. OPLISMENUS UNDULATIFOLIUS Beauv. L. 399. (New Braunfels). Aug. 1850. (210).

1264. PANICUM CAPILLARE L. L. 163. (Comanche Spring). Sept. 1849.

"On the Salado; thickets and roadsides."

P. LINDHEIMERI Nash. New Braunfels. 1849.

1265. P. PEDICELLATUM Vasey. L. 158. (Comanche Spring). Aug. 1849.

1266. P. PROLIFERUM Lam. L. 191. Comanche Spring. Sept. 1849.

1267. P. REVERCHONI Vasey. L. 162. Comanche Spring. Aug. 1849.

"In large bunches on fertile soil."

P. VIRGATUM L. L. 160. Comanche Spring. Sept. 1849. "Dry creek beds."

1268. P. VIRGATUM L. L. 160. Comanche Spring. Sept. 1849. (IV-723). *P. giganteum* Scheele.

1269. PASPALUM DISTICHUM L. L. 86. Comanche Spring. June 1849. "In water of spring."

1270. UNIOLA LATIFOLIA Michx. L. 370. New Braunfels. Aug. 1850. "Shady banks."

1271. ADIANTUM CAPILLUS–VENERIS L. L. 380. (New Braunfels). Aug. 1850.

1272. ANEIMIA MEXICANA Kl. L. 212. (New Braunfels). Nov. 1849. (III-572).

1273. ASPLENIUM RESILIENS Kze. L. 408. (New Braunfels. March) 1850.

1274. A. RESILIENS Kze. L. 215. (New Braunfels). Dec. 1849.

1275. DRYOPTERIS PATENS Ktze. var. MACROURA (Kaulf.). L. 382. (New Braunfels). July 1850. *Aspidium macrourum* Kaulf.

The large size of these fronds (1.5 m.), the long pinnae (1-2 dm.), with long falcate acute lobes and the thick texture seem to place our plants here, but it is doubtfully distinct from the smaller *D. patens* Ktze., which also occurs in this region.

1276. D. PATENS Ktze. var. MACROURA (Kaulf.). L. 322. (New Braunfels. 1850).

1277. NOTHOLAENA SINUATA Kaulf. L. 605. (New Braunfels). Nov. 1850. Form with deeply sinuate-dentate pinnae.

1278. N. SINUATA Kaulf. L. 414. (New Braunfels). May 1850.

Pinnae with fewer and more shallow lobes than in the typical form. A similar specimen in the Engelmann Herbarium is given as var. *argyrolepis* A. Br., but I have not been able to find the description.

1279. PELLAEA DEALBATA Prantl. L. 608. (New Braunfels). July 1851.

1280. P. FLEXUOSA Link. L. 463. (New Braunfels). May 1850.

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INDEX TO PLANTAE LINDHEIMERIANAE PARTS I–III.

In this index, the names in Roman type have been conformed to the Vienna Code of 1905, as far as was possible in the time at my disposal. Other specific names, regarded as synonyms, are in Italics with cross-references, the modern equivalents and corrections being given for Parts I and II.

The numbers in all cases refer to pages, those of Part I being to the reprint (pp. 2–56), to which it is necessary to add 208 in any given case to make the page correspond with the same in the Boston Journal of Natural History (**5**: 210–264). The references to pages of the present publication (Part III) are printed in Italics to distinguish them from the pages of Part II similarly numbered.

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ADDITIONS TO THE GENUS YUCCA.

BY WILLIAM TRELEASE.

Since the publication of my revision of the Yucceae in 1902,* three spontaneous Yuccas worthy of recognition have been discovered. Opportunity to see living material of *Y. valida* from Lower California has led to a re-examination entirely changing my opinion as to the distribution of that species. I have also had opportunity for repeated field observation on a very characteristic arborescent species common in the region about Tehuacan but not represented in the herbaria to which I have had earlier access. The conclusions on these species are embodied in the following annotated descriptions:

CHAENOYUCCA.

Yucca Harrimaniae Gilbertiana n. var.

Acaulescent. Leaves 2 cm. wide, about 45 cm. long, openly concave, drying striate, much roughened with prominent points on both faces, very light or blue green appearing almost as if glaucous, with stout straw-colored point; margin brown, with long rather straight and stout pale detached fibers. Flowers about 4 cm. long with narrow acute segments: filaments covered with long thick white papillae: ovary seemingly low-papillate, with oblong pale style.—*Plate 12.*

North end of Fish Spring or House Range, western Utah, G. K. Gilbert, Aug. 4, 1901. A little colony on a gravel slope of northern exposure, facing the Salt Lake Desert. Leaf material, slender stiff bracts and detached flowers occur in the U. S. National Herbarium, as well as the remains of a small sterile plant cultivated for a time at the Missouri Botanical Garden, from which a few leaves were removed for the Garden herbarium.

A rather striking form in its very rough papillate leaves, those of the type† being entirely smooth or with a few mostly low papillae near the apex.

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* Rept. Mo. Bot. Garden. **13**: 27.

† Rept. Mo. Bot. Gard. **13**: 59. *pl 28, 29, 83 f. 10, 93.*

Yucca rostrata linearis n. var.

Differing fom the type* in its narrowly linear leaves measuring 3–4 × 40 cm.,—those of the typical form being 6–12 (usually 8–10) mm. wide.

Cañons of the Sierra de Pata Salana and Sierra de Parras, Coahuila, Mexico, Purpus, 1904 and 1905. Cultivated at the Missouri Botanical Garden.

Leaves of the normal size for the species, entirely smooth-edged or locally with a few minute teeth, collected near Sabinas, Coahuila, in March, 1906, by Dr. Endlich, who gives "soyate" as the local name of the plant, represent another interesting form of *Y. rostrata*, which in its typical form should be noted as the *Y. rupicola rigida* of Mr. Watson in Proc. Amer. Acad. **18 :** 163, (1883), where a description is given of Palmer's material from Monclova in the same Mexican state.

Heteroyucca.

Yucca gigantea Lemaire.

Fruit received from an Azorean garden in the autumn of 1902 shows that this is really one of the Sarcoyuccas, and the name should doubtless take place as a synonym of *Y. elephantipes*, where it would have been located in the monograph† except for the seemingly aberrant fruit.

Sarcoyucca.

Yucca valida Brandegee, Proc. Calif. Acad. ii. **2 :** 208. *pl. 11.*—Gard. & For. **3 :** 106.—Trelease, Rept. Mo. Bot. Gard. **13 :** 108 (as to Lower Californian material). *pl. 67.*

Arborescent, 15–20 ft. [4.5–6 m.] high, trunks 8 in. [20 cm.] -2 ft. [61 cm.] or more in diameter, growing in clumps and branching from near the base or higher: leaves [lanceolate], thin, smooth, flexible, 6–9 in. [15–23 cm.] long, ½–¾ in. [1.2–2 cm.] wide at the center, tapering to a stout involute spine above, and narrowed to less than half its width above the brown, dilated base, margin separating into slender [to coarse] whitish recurved threads, [the cluster of green leaves elongated]. Panicle pyramidal, about 1 ft. [30 cm.] long, somewhat pubescent. Perianth cream-

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* Rept. Mo. Bot. Gard. **13 :** 68. *pl. 36 f. 2, 40–42, 84 f. 3, 93.*

† Rept. Mo. Bot. Gard. **13 :** 71.

white, 2–2½ in. [5–6.5 cm.] broad, on pedicels nearly as long as the segments, which are broadly lanceolate and nearly equal in width: stamens papillose, less than half as long as the segments, about equaling the style, uncinate after maturity; anthers sagittate: ovary oblong, abruptly narrowed to the nearly sessile stigma; ovules thick.

San Jorge to S. Borgia, Lower California, forming forests near Patrocinia, *fide* Brandegee.—Specimens seen from San Gregorio (Brandegee) and Rosario (Orcutt), and a living plant at the Missouri Botanical Garden from Mr. Brandegee.

YUCCA VALIDA AND ALLIES.

1. Y. VALIDA. 2. Y. AUSTRALIS. 3. Y. DECIPIENS. 4. Y. PERICULOSA.

Abundantly distinct in its smaller size, elongated leaf-clusters even when mature, decidedly shorter and more lanceolate leaves and shorter pubescent panicle, from the species of the interior which was joined to it with some hesitancy. The foregoing description, with slight bracketed modifications, is that of its author. The short panicles probably continue the direction of growth of the branches, and the fruit is doubtless pendent and baccate, with thick rugose seeds.

Yucca decipiens n. sp.

Y. valida Trelease, Rept. Mo. Bot. Gard. **13**: 107–9. *pl. 62–66, 85 f. 3* (exclusive of the Lower California notes and of *pl. 67*, which refer to the true *Y. valida*).

Arborescent, very rough-barked, at length sometimes 2 m. thick, 8–10 m. high and openly branched above. Leaves essentially smooth, elongated, oblong-lanceolate, 1–(mostly 2–) 4 × 30–60 cm. or more, ending in a usually very heavy point, finely to coarsely filiferous or sometimes soon denuded, with the whitish threads rather straight, the cluster of green leaves on mature trees nearly isodiametric. Panicle not pendent, short-stalked, about 1.5 m. long, broadly ovoid, mostly compact, glabrous or with the pedicels minutely puberulous. Flowers creamy white: perianth segments .9–1.5 × 3–4 cm., one series frequently narrower than the other: style rather short. Fruit pendent, baccate, oblong, 2 × 6–8 cm.: seeds thick, 6–7 × 7–8 mm.

Central table-land of Mexico, from Durango to below San Luis Potosi: typically represented about Gutierrez.

The more western representative of *Y. australis*, which differs conspicuously in its long-stalked elongated pendent panicle, though very closely resembling it in general.

YUCCA PERICULOSA Baker, Gard. Chron. **1870**: 1088.—Trelease, Rept. Mo. Bot. Gard. **13**: 103.

Y. baccata periculosa Baker, Journ. Linn. Soc. Bot. **18**: 229. (1880).
Y. circinata Baker, Gard. Chron. **1870**: 1088.
Y. baccata circinata Baker, Journ. Linn. Soc. Bot. **18**: 230. (1880).
Y. aloifolia Karsten & Stahl, Veg. Bilder. **1**[8]. *pl. 45.*

Arborescent, often cespitose, slender and rather smooth-barked, becoming about 6 m. high, mostly with few ascending branches. Leaves smooth, elongated, oblong- to linear-lanceolate, 2–3.5 × 35–50 cm., ending in a rather short point, rather finely and abundantly filiferous with the brown threads circinately coiled at least on young plants, the cluster of green leaves about isodiametric. Panicle not pendent, short stalked, scarcely 1 m. long, broadly ovoid, compact, tomentose. Pedicels 10–15 mm. long. Flowers creamy white: perianth segments mostly pubescent, 1–1.2 × 3.5 cm.; style abrupt and short. Fruit pendent, baccate, oblong, about as in *Y. decipiens:* seeds unknown.—*Plates 13, 14.*

Southern table-land of Mexico, from Tehuacan toward Esperanza and as far as Limon.

The southern representative of *Y. decipiens*, character-

istically subsimple and slender in habit and differing also in its tomentose inflorescence and very circinately brown-filiferous juvenile leaves.

This was described and named by Mr. Baker from young but fairly large specimens cultivated in 1870 by Mr. Wilson Saunders, and a leaf of "*Y. filifera*" collected in 1869 by Engelmann from a plant which Cels, of Paris, had received from Mexico through Galeotti, evidently represents the same species, and Engelmann noted seeing it also at Guedeney's under the more erroneous name *canaliculata*. On the other hand, the straighter, slenderer and paler marginal threads shown by type leaves of *Y. scabrifolia* and *Y. polyphylla* (a name later abandoned by Mr. Baker without explanation) scarcely permit those names to be removed from their former location under *australis* in the absence of other information than has yet been published.

Yucca Endlichiana n. sp.

Acaulescent. Leaves few, erect, thick and rigid, 1.5 × scarcely 50 cm., half-round near the base, narrowly V-shaped above, smooth, bluish-green somewhat dappled beneath with longitudinal dark dashes near the very short thick gray point, the basal part of which is blackish-purple: margin brown, rather finely or sparingly filiferous below, the stiff recurving fibers becoming short and very thick near the apex. Panicle shorter than the leaves, freely branched, the branchlets about 6-flowered. Flowers on filiform pedicels over 2.5 cm. long, creamy to dull purplish brown, very small for the genus: perianth segments ovate, acute, about .8 × 1.5 cm.: filaments short, minutely papillate: ovary oblong, surmounted by a slender style of about half its length. Fruit pendent, subglobose or broadly ellipsoidal, 2 × 2.5 to 3 cm., with thin flesh quickly drying: seeds 5 to 6 × 6 to 7 mm., rather thin, the albumen shallowly runimated.—*Plates 15–17.*

Marte, on the Mexican Central Railway, Coahuila, Mexico, and elsewhere, about the Sierra de Parras, the Sierra del Rosario, and the Sierra de la Paila. Received from, and named for, Dr. R. Endlich, who states that it is called "pitilla," and is said to produce a better fiber than that of the common lechuguilla (*Agave Lecheguilla*).

A very distinct and remarkable species differing from all other Sarcoyuccas in its very small, often dark flowers, thin-

walled fruit, and thin seeds. In a synopsis of species (*cf.* Rept. Mo. Bot. Gard. **13**: 46) it would find place immediately before *Y. baccata* with the characters "Acaulescent: flowers very small for the genus: style elongated."

Type material occurs in the herbarium of the Missouri Botanical Garden, where living but unthrifty small plants are also cultivated.

EXPLANATION OF PLATES.

Plate 12.—*Yucca Harrimaniae Gilbertiana*, × ½. A small cultivated plant (Gilbert, no. 516).

Plate 13.—*Yucca periculosa*. Representative plants, in the mountains near Tehuacan.

Plate 14.—*Yucca periculosa*. A young plant with characteristic foliage.

Plate 15.—*Yucca Endlichiana*. 1, Plants in the Sierra de la Paila, Coahuila, photograped by Sr. Teresa, × $\frac{1}{20}$. 2, Fruit and seed, natural size.

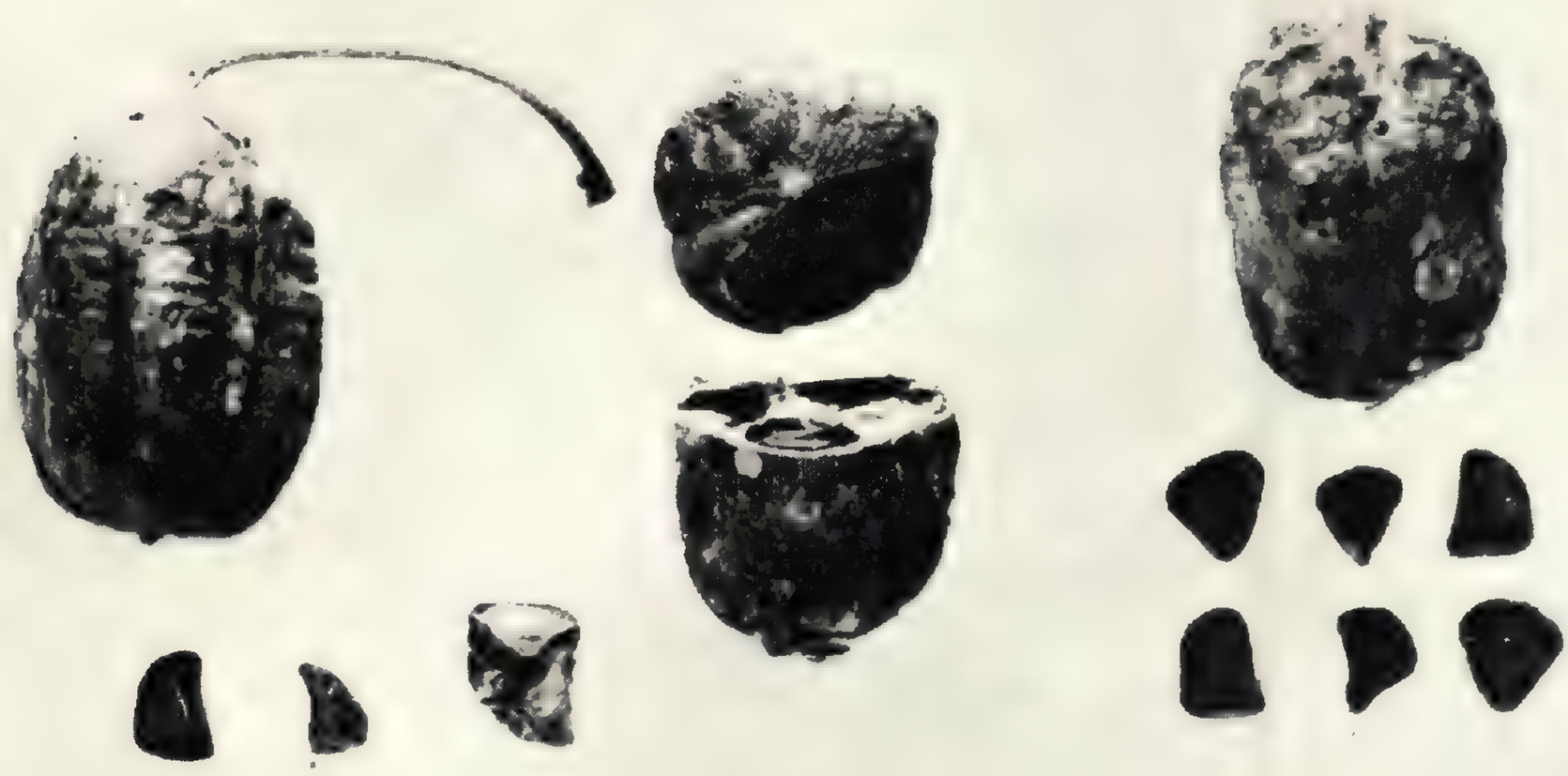
Plate 16.—*Yucca Endlichiana*. Inflorescence, natural size.

Plate 17.—*Yucca Endlichiana*. Fruiting panicle with surrounding leaf bases, natural size.

YUCCA HARRIMANIAE GILBERTIANA.

YUCCA PERICULOSA.

YUCCA PERICULOSA.



YUCCA ENDLICHIANA.

YUCCA ENDLICHIANA.

AGAVE MACROACANTHA AND ALLIED EUAGAVES.

By William Trelease.

In 1833, Zuccarini* characterized, with unusual accuracy for the time, several Mexican species of *Agave* which had been sent to the Munich Garden in small specimens by Karwinski, who is known to have spent four years in Oaxaca.

Three of these, evidently closely related, were named *A. macroacantha*, *A. pugioniformis*, and *A. Karwinskii*. All had erecto-patent rigid leaves with strong blackish end-spine and marginal prickles, the latter noted as sometimes fleshy-based in the second species. The intervening margin in all is described as herbaceous (in contrast with the horny margin of *A. heteracantha*) and glabrous (apparently in contrast with *A. striata*, where it is very scabrid). The first two, when described, were acaulescent and with glaucous or glaucescent foliage: the third had a short trunk and green leaves. Though their names still appear in various connections, the second and third have been practically lost to botanical knowledge for nearly half a century, and the other is usually credited to a wrong primary division of the genus.

The year following their description, Salm Dyck,† who possessed the most noted succulent collection of his day, in a list of the Agaves known to him recognized the first two of these species, but made no mention of the third. Under *A. macroacantha* he adds a remark that *A. flavescens* (a name not earlier published, but said to be of Munich origin and presumably applied to a plant likewise collected by Karwinski) closely approaches and may be a seminal variation of this species, differing in its subrecurving leaves and less colored prickles.

In his classical treatise on the Amaryllidaceae, Herbert‡ lists the three species of Zuccarini, but writes *macracantha*

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* Zuccarini, Act. Acad. Caes. Leop. Carol. Nat. Cur. **16²**: 676–7. (1833).

† Salm Dyck, Hortus Dyckensis. 8, 305–6. (1834).

‡ Herbert, Amaryllidaceae. 127–8. (1837).

there spelled, to a variety of *flavescens* (p. 16), transfers *A. pugioniformis* to a quite different alliance (p. 18) and includes an additional name, *A. Besseriana* (called *Besserer-iana* by its collector, Roezl), of the Belgian dealers, who had listed it at least since 1861, this—spelled *Besserreriana*—being reduced to a synonym of *A. flavescens* in the Nachtrag of 1867 (p. 7), in which the new association is maintained for *A. pugioniformis* (p. 9).

His account of *A. macracantha*, which is separately described (p. 92) though regarded as only a robust variety of *A. flavescens* (p. 91), shows that Jacobi had been an observer of Salm's plants of both, which are respectively redescribed as caulescent and subcaulescent, in contrast with the earlier descriptions of young plants and with the existing plants of *Besseriana* which, though having less glaucous and more spreading leaves with smaller and closer-set prickles, was considered as perhaps placeable under *flavescens* in case it were to develop a trunk in age,—a conclusion, as has been said, reached without qualification in the Nachtrag (p. 7), and in a still later article* on new importations by Besserer himself. The type of this had been exhibited at the Ghent exposition of 1863 by De Smet.

To the original description of *A. Karwinskii*, Jacobi (p. 93) adds in his monograph that the trunk of Salm Dyck's plant had increased to a length of over a foot before its death. He states that, suckering but little, this had already become very rare in Europe: it may be questioned whether any botanist has since observed a derivative of Zuccarini's original material. Jacobi recognized as belonging to this species a well-developed plant in the De Smet exhibit already referred to, where it was marked as a unique new importation, but without name. It may be assumed that Roezl rather than Besserer was the collector, and that this individual, the history of which is lost, was of the same species as De Smet's *Corderoyii* of a few years later.

Apparently it was only because of the more spreading and

* Von Jacobi, Wochenschr. des Vereins zur Beförd. des Gartenbaues etc. **1869**: 178.

concave leaves of *A. pugioniformis* when young that Jacobi transferred it from its earlier association next the other large-toothed species, *macroacantha* and *Karwinskii* (where it had still been left by Salm in his list of 1861), to his own group of "Canaliculatae," in which (p. 18) its collocation is particularly unfortunate in several respects: but his description (p. 142), though specimens are not cited, is evidently drawn from living material, presumably in Salm's collection.

Cels, of Paris, a dealer in succulents who seems to have given unusually intelligent study to his collections, published an "Agavearum systema naturalis" in the form of a chart folded into his trade catalogue of 1865, in which he places *macroacantha* (with *Bessereriana* Roezl as a synonym) under his own "Angustifoliae," treating "*A. pugioniferus* [*pugioniformis*] Zucc." as a variety *pugioniferus* of it; but he makes no mention of *Karwinskii*.

Karwinski's plants of all these Agaves were probably collected in the state of Oaxaca, and perhaps not far from the city of that name. Roezl and Besserer more certainly collected theirs in the vicinity of Tehuacan, between Oaxaca and Puebla.

At about this time various dealers were listing *A. Besserer-iana, Bessereriana candida,* and *brevifolia* and *longifolia* forms of the latter; and Laurentius* advertised—with seemingly characteristic and certainly well executed figures of them—two forms which he called *A. Bessereriana longifolia glauca* and *A. Bessereriana longifolia viridis*,† stating, however, that neither had any connection with the earlier *Bessereriana*. These plants seem to represent the fruits of Besserer's own collecting in 1868.

Jacobi secured these and other Agaves offered by Laurentius, and published‡ no less than four supposedly new species

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* Laurentius, Cat. **1869:** 15, 16.

† Laurentius's wood-cuts were reproduced in the Florist and Pomologist of 1870 and the Gardeners' Chronicle of 1871, the glaucous form being called *A. Bessereriana glauca*, and the green one *A. Bessereriana* or *A. Bessereriana viridis*.

‡ Von Jacobi, Wochenschr. Verein. Beförd. Gartenbau. **1869:** 177–180.

which he found among them, two of which are of interest here: *A. subfalcata* and *A. linearia*. The first, with laterally subfalcate dull gray-green leaves, elongate-lanceolate, and somewhat narrowed above the base, is said to be comparable in color only with another plant imported by the same collector as *A. Besseriana*, which is considered to be typical *A. macrantha* Karw. (evidently a slip for *A. macroacantha* Zucc.): Roezl's earlier plants named after Besserer in Belgian gardens being now, as before, kept apart by Jacobi as representing *A. flavescens*. Of the dull deep-green-leaved *A. linearia*, Jacobi says that it might perhaps be considered a climatic form of the other had not both been found together. Like all of the species thus far, these, which come close to *pugioniformis*, were described from young plants only. In his Zweiter Nachtrag (p. 75), Jacobi repeats his two later species, correcting *linearia* to *linearis*, with the definite information that both were collected at the "Cerro Colorado," a prominent red cliff marking the landscape in sight of Tehuacan. In his synonymy the earlier spelling of *macrantha* is here changed to *macracantha*, and Jacobi adds the suggestion that *A. subfalcata* may prove identical with his *A. flavoviridis*.*

In 1871 a small plant that Saunders had bought in Belgium a few years earlier as *A. Besseriana hystrix* (probably one of Besserer's plants of 1868) flowered, and Sir Joseph Hooker† figured and described it under Jacobi's name *Besseriana*. This seems to be the first flowering record relating to any of this group of Agaves. The plant was evidently a starveling,

* This name seems not to appear elsewhere. Probably it is a misprint for *A. flavovirens*, which—Versuch. 258–261. (1866)—Jacobi had applied to a nearly acaulescent plant with (at flowering time) pale greenish-yellow spreading-recurved leaves and unusual flower structure, that bloomed in a garden at Bellagio, Italy. Nothing seems to be known of this species aside from the type description. The very peculiar flower structure, though not comparable with anything that I have seen in fresh *Agave* flowers, matches fairly well what is to be seen in flower-remnants on the capsules of *A. Jacquiniana* or *angustifolia*, and the affinities of *A. flavovirens* seem more likely to lie with this group of species than with the related but different *macroacantha* group.

† Hooker, Curtis's Bot. Mag. III. **27.** *pl. 5940*. (1871).

and the green flowers, though obviously those of Euagave, are shown as solitary or paired in a short raceme.

No clear record is found of subsequent trade importations of any of the *macroacantha* group, though a glaucous specimen was exhibited in May 1874 at Florence by Verschaffelt, and in England by Croucher, as *A. Besseriana major*.*

Reference has already been made to an *Agave* advertised by De Smet† under the name *A. Corderoyii*, with the statement that it was unrelated to any other species, and that the Belgian stock consisted of a single individual. This applies inferentially to what Jacobi had taken for *Karwinskii*. Another plant of this had evidently been sold to Corderoy, whose name was affixed to the species: this specimen was subsequently resold to Peacock,‡ and served as the type of *A. Corderoyi* Baker.§ The name *Corderoyi* is found mentioned in 1874,‖ at about which time Nardy sold it, and *A. Corderoyi brevifolia* is said to have been among the plants exhibited by Verschaffelt at Florence that year.¶

On the basis of the large English succulent collections of the day which contained most of the novelties, and aided by such Continental collections as those of Ellemeet and Kerchove which perpetuated more or less authoritatively the names of Jacobi's period, though the still earlier types had been scattered or lost to cultivation for the most part, Mr. Baker now revised the Agaves.** Of the forms here in question, he admits *A. macracantha* (p. 137), noting his inability to separate specifically *A. flavescens*, *A. Bessereriana*, *A. Bessereriana candida* (*f. 27*, as *A. macrantha*), *A. subfalcata*, or *A. linearis*. In the Peacock collection he found a plant under the name *A. sudburyensis* to which, for some reason, he transferred the specific name *concinna* (which was

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* The Garden. **7**: 456. (1875).—Belg. Hort. **1875**: 43.

† De Smet, Cat. no. 5 : 14. (1869).

‡ Corderoy, Gard. Chron. n. s. **8**: 469. (1877).—Mention is also made of *A. Corderoyii glauca*, doubtless one of the *subfalcata* forms.

§ Baker, Gard. Chron. n. s. **8**: 398. *f. 79.* (1877).

‖ Belg. Hort. **1874**: 25.

¶ Belg. Hort. **1875**: 43.—The Garden. **7**: 456. (1875).

** Baker, Gard. Chron. n. s. **8.** (1877).

then current in gardens for a very different Littaea that he himself—p. 717—placed under *A. albicans*), noting as differentials from his *macracantha* its somewhat thinner, broader and less glaucous leaves with larger more hooked prickles. Shortly after the publication of his monograph he found a small plant, obviously of this alliance, in the Corderoy collection, which, because of its few leaves, he called *paucifolia*,—subsequently changing this to *oligophylla* when the earlier name was found preoccupied. Mr. Baker follows Jacobi's lead in ranging *A. pugioniformis* among the flexible-leaved species of his own group "Viviparae,"—apparently knowing it only from description. He also acts on suggestions made by Engelmann in 1873, in treating *A. Karwinskii* as a synonym of *A. Ixtli*.* Here, for the first time, is given a description, accompanied by a woodcut, of *A. Corderoyi* (p. 398, *f. 79*), which, placed but one remove from *A. Ixtli* in the monograph, is said to be recognizable at a glance by its very rigid narrow bright green leaves and by the shape of its dark brown erecto-patent prickles. Mr. Baker's monograph was rendered into Italian by Baron Ricasoli and the translation published in the following year.† What was said of these species in the Gardeners' Chronicle is here repeated (pp. 237, *f. 24*, 241, 306). Fenzi notes *A. Besserer-iana* as being cultivated in Florence‡ at this time; and a few years later Croucher§ comments on it; and it (spelled *Besseriana*) and *A. Corderoyi* as then understood are said‖ to have been collected by Roezl. Mr. Baker's conclusions were embodied in Hemsley's list of Mexican plants,¶ except that *A. Karwinskii* is placed under *A. rigida*, which replaces the *Ixtli* of Baker's monograph.

Shortly after this, Terracciano, having the opportunity of studying more mature specimens grown under the favorable

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* One of Karwinski's introductions (but from Yucatan), earlier described by Salm Dyck,—Hort. Dyck. 8, 304. (1834).

† Ricasoli, Bull. Soc. Tosc. Ort. **3.** (1878).

‡ Fenzi, Bull. Soc. Tosc. Ort. **3 :** 70. (1878).

§ Croucher, Gard. Chron. n. s. **14 :** 374. (1880).

‖ Belg. Hort. **1880 :** 276.

¶ Hemsley, Biol. Centr.-Amer. **3 :** 345, 347–8. [Feb 1884].

conditions of Italian gardens, in his turn undertook a revision of *Agave*,* in which (p. 29) *A. Besseriana*, *A. Besseriana candida*, *A. flavescens*, *A. flavescens macracantha*, *A. linearis* and *A. subfalcata* are ranged under *A. macracantha; A. concinna* is made a variety of the same species; *A. pugioniformis*, treated as of uncertain position, is evidently known from description only; *A. Karwinskii* or *Karwinskiana* is placed under *A. Ixtli* (p. 44); and *A. Corderoyi*, of which he seems to have examined a young plant, is located next the latter (p. 45). Adding to the difficulties caused by frequent changes and typographical errors in spelling *macroacantha*, Terracciano treats *A. macrantha* Todaro† as a variety of *macracantha*, the inflorescence of which was then known only from the seemingly racemose plant figured by Hooker, while Todaro's species is obviously a true Littaea. Terracciano's disposition of earlier references is essentially that of Baker.

A few years later still, Mr. Baker‡, who had continued his study of the Agaveae, embodied his conclusions in a monograph of the entire group Amaryllideae. The treatment is essentially along the lines of his Gardeners' Chronicle revision but lacks the illustrations of the earlier paper, and some conclusions have lost their first keenness of insight. This book was afterwards put into Spanish by Segura§ as part of a publication which has gone through several editions. In the Handbook,—which to-day is the most-used reference work on *Agave*,—*A. macracantha* is placed among the Littaeas—as it had been placed among the equivalent Geminiflorae by Terracciano, on the misunderstood Botanical Magazine figure. Of it, *A. flavescens* and *A. Bessereriana* are considered to be synonyms, and *A. subfalcata* and *A. linearis* are said not to be specifically separable. *A. concinna* and *A. oligophylla* are maintained. *A. pugioniformis*, which Mr. Baker says he had never seen, is still ranged among

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* Terracciano, Primo Contributo ad una monografia delle Agave. Napoli. 1885.

† Todaro, Hort. Panormit. **2 :** 11. *pl.* 27. (1879).

‡ Baker, Handbook of the Amaryllideae. London. 1888.

§ *E. g.* Segura, El Maguey. 4 ed. 51–136. (1901).

the "Viviparae." *A. Karwinskii* is kept as a synonym of *A. rigida*, under which *A. Ixtli* is also entered, and which *A. Corderoyi* immediately follows with the statement, once more, that it was introduced through De Smet by Roezl.

In his now otherwise voidable group "Integrifoliae," Mr. Baker here describes (p. 185) as *A. integrifolia* a plant with rigid glaucous leaves devoid of prickles, received in 1885 from the Missouri Botanical Garden. What is said of it hardly permits it to be placed far from *macroacantha* except for the absence of marginal prickles. Mr. Gurney, long the Head Gardener of the Missouri Botanical Garden, remembers that somewhere about 1880 a packet of seed of "*A. Besseriana*" was received (as he thinks from Haage and Schmidt), from which not far from 100 seedlings were raised. All are said to have been glaucous, some less than others; and he recollects that while most were very prickly some were armed only at the apex of the leaves. The local absence of prickles on *A. macroacantha* had also been noted by Salm.* There seems to be a bare possibility that the type of *A. integrifolia* was an extreme form of this lot of seedlings, of which several—all, however, of the prickly *macroacantha* form—are still extant.

In 1893 a plant which had been obtained in 1875 from Nardy of Hyères, under the name *A. Corderoyi*, flowered at Palermo. Not being satisfied with the name that it bore,—as had been true in nearly all of the observations made by Todaro on plants brought to maturity in the same garden, when comparison was made with the type descriptions of small specimens,—Dr. Ross, who was then at Palermo, submitted a leaf to Mr. Baker, who confirmed his doubts, so that the plant was described† and subsequently well figured‡ by him under the name *A. Bakeri*. A leaf of a similar plant cultivated at the Missouri Botanical Garden as *A. Corderoyi* and understood to have been obtained as *A. lurida Jacquiniana* from Ellwanger and Barry between 1875 and

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* Salm Dyck, Bonplandia. **7**: 90. (1859).

† Ross, Boll. Soc. Sc. Nat. ed Econ. Palermo. **1894**[3].

‡ Ross, Icon. et Descr. Pl. Nov. vel Rar. Horti Bot. Panormit. 4. *pl. 2.* (1896).

1880, was sent to Dr. Ross and likewise identified with his new species, which was an openly paniculate Euagave, with olive green flowers of a general resemblance individually to those figured by Hooker for *A. Besseriana*.

No later publications throw any additional light on this group of species, though some of them have received passing mention or encyclopaedic treatment.

Summarized, the literature shows that Zuccarini's three species, *Agave macroacantha*, *A. pugioniformis* and *A. Karwinskii*, with the others here associated with them, not definitely known to occur spontaneously outside of the region between Puebla and Mitla, constitute a natural subdivision of Mr. Baker's group "Rigidae," the species of which, properly limited, are normally paniculate in inflorescence and likewise with the flowers, capsules and seeds of typical Euagaves.

Repeated personal observation of the plants in this region, which is very rich in forms of *Agave*, has led to the belief that there are but two separable species of this series, one of them, *A. macroacantha*, comprising a number of what for the present must be considered as hardly more than individual variants, while the other, *A. Karwinskii*, seems more constant in its characters, except that in the southern part of its range it becomes a veritable tree when fully developed. I have also had the satisfaction of seeing one of the old *Besseriana* plants of the Missouri Botanical Garden flower and fruit, corroborating conclusions based in the field on foliage, bud, and fruiting material only.

Though the leaf margin between the prickles is often quite smooth, as was described for the original plants, it is frequently granular-roughened in both species, especially in the first-named,—locally if not throughout, and this character is shown by the Munich sheet of *A. pugioniformis*, the authenticity of which appears reasonably certain. As with many other Agaves, the margin on very young specimens is not herbaceous in the sense of being green, but is white and might be called cartilaginous if it persisted on mature leaves, as it does more or less regularly in the related species of the *tequilana* alliance.

As forming a natural Euagave group, what may be called

the "Macroacanthae" are distinguished from the related fetid-flowered "Sisalanae" by an oblong-conical rather than urceolate perianth tube, dull seeds, and usually somewhat decurrent horny margin for a short distance below the more grooved terminal spine; and from the more closely related "Tequilanae" in that this margin is not usually so sharply upturned, and hence limits a less marked quadrate trough next the base of the spine, while the prickles are heavier-based than in either. The three groups, perhaps with the addition of a fourth, "Miradorenses", are apparently the equivalent of Mr. Baker's "Rigidae" after elimination of its known or presumable Littaea component—the general affinities of which are with his "Aloideae," notwithstanding a somewhat artificially defined greater firmness of leaf texture.

The Macroacanthae agree in an open, often flexuously and few-branched at length bulbiferous oblong panicle about as long as the sparsely bracted scape, subsessile not fetid greenish oblong flowers with the filaments inserted between the middle and upper third of the tube in two mostly distinct series, broadly oblong stipitate and beaked capsules with interlacing fibers between their dehiscent valves, and dull heavily and therefore inconspicuously winged seeds.

In the concise technical treatment which follows, the synonymy* is so subdivided as to make possible the application of an appropriate name to possible segregates of either species; but this has been done with the feeling that segregation, to have any real meaning, will need to be effected in the field, rather than on isolated and aberrant garden specimens or on the early descriptions if taken too literally. The real nature and the causation of the multiplicity of forms in *A. macroacantha* and the associated very dissimilar but equally multiform *A. Verschaffeltii* of the Tehuacan region present a clean-cut fundamental problem to capable ecologists.

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* Dealers' catalogues, though occasionally loosely descriptive, are usually bare lists of names; yet they sometimes throw valuable light on the plants of this group. I regret sincerely my inability to make the citation of such catalogues even fuller than it is.

The two admitted species of the Macroacanthae may be separated as follows:

Subacaulescent; gray or glaucous throughout. *A. macroacantha.*
Caulescent, the trunk 1–4 m. high; green, not glaucous or only evanescently glaucescent. *A. Karwinskii.*

Several other names, which have been practically book names for the last forty years, should be touched on in connection with the foregoing, since they pertained originally to plants which Karwinski had sent to the Munich Garden, perhaps from the vicinity of Oaxaca.

In the enumeration of species that he was cultivating in 1834, Salm* includes *A. laxa*, *A. punctata* and *A. rubescens*, and describes (p. 306) the two last named, giving as a synonym of *rubescens*, *A. flaccida*, under which name he had received the plant from Munich. Another name, *serrulata*, of Karwinski, appears in Otto's bare enumeration of Berlin Agaves, in 1842.

A. laxa, as it had been labeled at Munich, is listed by Steudel in 1841, Otto in 1842, Roemer in 1847, and Kunth in 1850 (with inclusion—p. 837—of an ambiguous location of it under *A. Karwinskii* by Otto,† and a suggestion—p. 838—by Bouché, who had seen the Berlin specimen, that it might be the same as *pugioniformis*). It was first described in Salm's‡ monograph of 1859, where it stands between *Karwinskii* and *pugioniformis*. The following year Koch§ located it between *A. Jacquiniana*, which he seems to have understood, and *Karwinskyi*. In his commentary on Koch's revision, Salm‖ groups *laxa*, *serrulata* and *rubescens* as a linear, lax, serrulate foliaged series of a division "Micracanthae," apart from his "Macracanthae" in which the *macroacantha* series are placed. The same considerations led Jacobi¶ in

* Salm Dyck, Hortus Dyckensis. 8.

† What Otto seems to have meant was that *punctata*, which he placed under *Karwinskii*, might really be rather *laxa*.

‡ Salm Dyck, Bonplandia. **7**: 90.

§ Koch, Wochenschr. **3**: 48,—and translations.

‖ Salm Dyck, Wochenschrift. **1861**: 182; Fl. des Jard. **5**: 124. (1862).

¶ See von Jacobi, Versuch. 18, 146.

1865 to place these three species in his own group "Canaliculatae," to which *pugioniformis*, *Rumphii* and *yuccaefolia* were added. His description of *laxa* seems to have been drawn from a re-examination of Salm's plant of 1859. Cels, in his "Systema" tabulation of 1865, places *A. Cantala* and *A. laxa* at the end of his "Angustifoliae," treating "*Rhumphii*," *serrulata* and *rubescens* as varieties of the latter, with *punctata* and *flaccida* as synonyms of *rubescens*. Baker* held *laxa* for a possible variety of *A. vivipara*, which, as he understood it, was practically *A. Cantala* (of which *Rumphii* has been considered to be a synonym). He clearly had not seen the species of Salm and Jacobi, and his *laxa* is apparently justly considered by Drummond and Prain in their recent notes on *Agave* and *Furcraea* in India† to be only a flaccid form of *A. Cantala*. Terracciano,‡ following Kunth's expression as to Otto's queried identification of *laxa* with *Karwinskii*, places it (p. 44) as a possible synonym of *A. Ixtli*, to which the latter is referred. He elsewhere (p. 47) treats *laxa* (of Baker) as a variety of *A. sobolifera*, to which rather than *vivipara* (in Baker's sense, *i. e. Cantala*) he considers it related.

A. punctata, listed (p. 8) and described (p. 306) by Salm§ in 1834, had been so named in the Berlin Garden, presumably on a plant received from Munich, though there seems now to be no way of learning what name it bore there. In 1842 Otto considered it to be the same as *Karwinskii*, or perhaps equivalent to *laxa*,—both Munich names. In this he was followed by Kunth in 1850, and Terracciano in 1885, the latter placing it, as such, under *A. Ixtli*. In his monograph of 1859,‖ Salm, who must be considered to have known it better than any one else, enters it as a frank synonym of *rubescens*, in which treatment he is followed by Koch and Jacobi,—the name practically disappearing after the latter,

* Baker, Gard. Chron. n. s. **8**: 780. *f. 151.* (1877); Handb. Amaryll. 194. (1888).

† Agricultural Ledger. **1906**: 88, 132.

‡ Terracciano, Primo Contributo. 44, 47. (1885).

§ Salm Dyck, Hortus Dyckensis.

‖ Salm Dyck, Bonplandia. **7**: 91.

though it stands without cross reference in the Index Kewensis.

A. rubescens, listed by Salm* and described by him in 1834 immediately following what he at first called *A. punctata* but afterwards considered to be the same as *rubescens*, has had its synonymy complicated because of its original distribution from the Munich Garden under the name *A. flaccida*, which was discarded by Salm because of the earlier use of this name for something else by Haworth.† The same name was subsequently applied by Jacobi‡ to a still different plant. It is listed by Otto in 1842 and Roemer in 1847, and included in Kunth's enumeration of 1850. Salm in 1859, Koch in 1860, and Jacobi in 1865 redescribed it, the first certainly from authentic specimens. Jacobi, ignoring Salm's original indication that it is Mexican, questions its nativity. Apparently through a typographical error for this, the name *erubescens* appears in Ellemeet's list of his Agaves in 1871, and has been repeated a few times. Mr. Baker, in 1877, at first§ suggested the possible identity of *rubescens* with the *flaccida* of Jacobi, which, as has been said, was something entirely different, but later‖ admitted it as a species. He was followed in his first erroneous suggestion by Terracciano (p. 38). There is no indication that any writer since Jacobi has seen authentic *rubescens*, and it may be that even he did not see it.

The equivalent name *A. flaccida* of the Munich Garden is properly treated as a synonym (after its introduction as such by Salm in 1834) by Kunth in 1850, Salm in 1859 and Koch in 1860. Other uses of this name, as has been said, pertain to quite different plants—whatever they may have been—so called in the first place respectively by Haworth and Jacobi.

A. serrulata, which had been listed (ascribed to Karwinski) by Otto in 1842 and Roemer in 1847, was repeated as a bare

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* Salm Dyck, Hortus Dyckensis. 8, 306.

† Haworth, Synops. Pl. Succulent. 72. (1812).

‡ Von Jacobi, Hamburger Gart.-Zeit. **22:** 174. (1866); Versuch. 226.

§ Baker, Gard. Chron. n. s. **8:** 137.

‖ *L. c.* 780; Handbook Amaryll. 194. (1888).

name by Kunth in 1850, except that he reports Bouché, who had grown it in the Berlin Garden, as considering it similar to *laxa*. It was first described in Salm's monograph of 1859, and placed between *pugioniformis* and *rubescens*. Koch, who adds nothing to the knowledge of it, locates it between *flavescens* and *rubescens*. Jacobi* redescribed Salm's original specimen in 1865, when he transferred *serrulata*, *rubescens* and *pugioniformis* to his own flaccid-leaved group. With the passing of the plants seen by Otto, Salm and Jacobi, *A. serrulata* has become merely a book consideration; and, though Van Houtte† listed an *Agave* under this name in 1868, I have found no evidence that it has been recognized since. What was cultivated in gardens about 1877 under this name has been said to be the very different *A. densiflora*.‡ Salm's location of *serrulata* between *pugioniformis* and *rubescens*, with Jacobi's arrangement§ of these apart from *macroacantha* or *Karwinskii*, is followed by Baker‖ (who had never seen it), Ricasoli, Hemsley and Segura. Terracciano,¶ apparently on a plant of the *sobolifera* series found under this name, but the history of which is not given, describes, with flower and fruit details, a broad, green-leaved paniculate *Agave* as *A. sobolifera serrulata*, giving *serrulata* as a synonym, and suggesting, with question, the propriety of uniting it with his own *A. sobolifera laxa*, which is made the equivalent of the *laxa* of Baker rather than Salm, though the latter is cited.

The history of the Karwinski plants cannot be closed without reference to the name *A. Zuccarinii*, once applied in the Berlin Garden to a plant evidently received from Munich and possibly representing one of the numerous foregoing species or synonyms. This was included in Otto's list of 1842 and Kunth's enumeration of 1850 where it passes into

* Von Jacobi, Versuch. 142.

† Van Houtte, Cat. 123 : 32.

‡ The Garden. **12 :** 396.

§ Following Salm, except for *pugioniformis*.—Wochenschrift. **1861:** 182; Fl. des Jard. **1862 :** 124.

‖ Baker, Gard. Chron. n. s. **8 :** 780. (1877); Handb. Amaryll. 193. (1888).

¶ Terracciano, Primo Contributo. 47. (1885).

oblivion, undescribed, with the statement that the specimen had died in the Berlin Garden.

A. laxa, serrulata and *rubescens* as understood by Salm agreed in having linear-lanceolate recurving concave leaves 1–1½ × 24–27 in., with rather small end spine and small marginal prickles. Koch* ultimately came to the conclusion that the three were identical, and merged them under the name *A. flaccida*, which he ascribes to Haworth rather than the Munich Garden. From the other two, so far as descriptions go, the true *laxa* differed in its greener color and more distant darker prickles, said by Jacobi to stand 1 in. apart. Its identity with the others is questionable, and, on the whole, Otto's reference of it to *A. Karwinskii* is no longer likely to be challenged on adequate grounds. The probability is that nothing more will ever be known of it, although the *laxa* of Baker† will require consideration when the set of *A. Cantala* are revised.

A. serrulata and *A. rubescens* are hardly differentiated by characters applicable to mature plants, from which the young plants differ markedly. From *laxa* they were distinguished by their gray green color, tinged with purplish in the second, and their closer white or orange-brown-tipped prickles. There is no great probability that they can be separated as components of the Mexican flora, but there is reason to believe that the names apply to a well-marked Euagave of the Tequilanae alliance, now found in the region between Tehuacan and Mitla, which is described below. Comparable fine toothing also marks the early stages of several of the Pacific slope species of the same group.

AGAVE MACROACANTHA Zuccarini, Act. Acad. Caes. Leop. Carol. **16²**: 676. (1833).—Salm, Hort. Dyck. 8, 305. (1834); Bonplandia. **7**: 90. (1859); Wochenschr. Ver. Beförd. Gartenbau. **1861**: 182; Fl. des Jard. **1862**: 123.—Steudel, Nom. 2 ed. 36. (1841).—Otto, Allgem. Gartenzeit. **1842**: 51.—Roemer, Fam. Synops. Monogr.,

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* Koch, Wochenschr. **8**: 101. (1865).

† Baker, Gard. Chron. n. s. **8**: 780. *f. 151.* (1877).—See also Croucher, Gard. Chron. **n. s. 6**: 720.

Ensatae. 290. (1847).—Koch, Wochenschr. Ver. Beförd. Gartenbau. **3**: 54. (1860); Fl. des Jard. **1861**: 149. Belg. Hort. **1862**: 312.—Jacobi, Hamburg. Gart.-Zeit; **1864**: 459, 461; Versuch. 6, 8.—Cels, Cat. **1865**: 18.—Hemsley, Biol. Centr.-Amer. **3**: 345. (1882–6).

A. macracantha Herbert, Amaryll. 127. (1837).—Kunth, Enum. **5**: 834. (1850).—Cels, Cat. **1861**: 19.—Jacobi, Hamburg. Gart.-Zeit. **1865**: 154; Versuch. 92.—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1865**: 102.—Baker, Gard. Chron. n. s. **8**: 137. (1877); Handbook Amaryll. 177. (1888).—Ricasoli, Bull. Soc. Tosc. Ort. **3**: 237. *f. 24*. (1878).—Terracciano, Primo Contributo. 29. (1885).—Nicholson, Dict. Gard. **1**: 40.—Kew Hand List Tend. Monocot. 115. (1897).—Rose in Bailey, Cyclop. Amer. Hort. **1**: 34. (1900).—Segura, El Maguey. 4 ed. 84. (1901).

A. flavescens macroacantha Jacobi, Hamburg. Gart.-Zeit. **1864**: 500.

A. flavescens macracantha Jacobi, Versuch. 16; Bull. Congr. Bot. et Hort. Amsterdam. 111. (1865).—Terracciano, Primo Contributo. 29. (1885).

A. Bessereriana Van Houtte, Cat. **1868**: 32; **1869**: 15.—Ellemeet, Belg. Hort. **21**: 118. (1871).—Gartenflora. **21**: 122. (1872).—Baker, Gard. Chron. n. s. **8**: 137. (1877); Handbook Amaryll. 177. (1888).—Fenzi, Bull. Soc. Tosc. Ort. **3**: 70. (1878).—Peacock, List. 2. (1878).—Croucher, Gard. Chron. n. s. **14**: 374. (1880).

A. Besseriana Jacobi, Wochenschr. Ver. Beförd. Gartenbau. **1869**: 178.—Laurentius, Cat. **1869**: 113.—Hooker, Curt. Bot. Mag. III. **27.** *pl. 5940.* (1871).—Belg. Hort. **1871**: 243; **1880**: 276.—Hemsley, Biol. Centr.-Amer. **3**: 345. (1882–6).—Terracciano, Primo Contributo. 29. (1885).—Nicholson, Dict. Gard. **1**: 40.

A. Besseriana hystrix Fl. and Pomol. **1868**: 75.—Hooker, Curt. Bot. Mag. III. **27.** under *pl. 5940.* (1871).

A. Bessereriana hystrix Peacock, List. 2. (1878).

A macrantha Jacobi, Wochenschr. Ver. Beförd. Gartenbau. **1869**: 178.

A. macrocantha Peacock, List. 3. (1878).

A. flavescens Salm, Hort. Dyck. 8, 305. (1834); Bonplandia. **7**: 90. (1859); Wochenschr. Ver. Beförd. Gartenbau. **1861**: 182; Fl. des Jard. **1862**: 123.—Steudel, Nom. 2 ed. 36. (1841).—Otto, Allgem. Gartenzeit. **1842**: 51.—Roemer, Fam. Synops. Monogr., Ensatae. 292. (1847).—Kunth, Enum. **5**: 835. (1850).—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1860**: 54; **1865**: 102; Fl. des Jard. **1861**: 149; Belg. Hort. **1862**: 312.—Jacobi, Hamburg. Gart.-Zeit. **1864**: 460, 461, 500; **1865**: 154; Versuch. 6, 8, 16, 91; Bull. Congr. Bot. et Hort. 111; Wochenschr. Ver. Beförd. Gartenbau. **1869**: 178.—Baker, Gard. Chron. n. s. **8**: 137. (1877); Handbook Amaryll. 177. (1888).—Hemsley, Biol. Centr.-Amer. **3**: 345. (1882–6). Terracciano, Primo Contributo. 29. (1885).—Nicholson, Dict. Gard. **1**: 40.

A. Bessereriana Cels, Cat. **1861:** 18; **1865:** 18.—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1865:** 102.—J. Verschaffelt, Cat. **1865–6:** 40.—Van Houtte, Cat. 113: 33; 116: 1. (1866).

A. Besseriana F. A. Haage, Cat. **1861:** 32.—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1862:** 198; **1864:** 164.—Jacobi, Hamburg. Gart.-Zeit. **1864:** 500; **1865:** 155; Bull. Congr. Bot. et Hort. Amsterdam. 111. (1866); Versuch. 16, 92; Wochenschr. Ver. Beförd. Gartenbau. **1869:** 178.

A. Besserreriana Jacobi, Versuch. Index. 4. (1867); Nachtrag. 7. (1867).

? *A. macracantha nigrispina* Cels, Cat. **1861:** 19.

? *A. macroacantha nigrispina* Cels, Cat. **1865:** 18.

A. pugioniformis Zuccarini, Act. Acad. Caes. Leop. Carol. **16¹:** 676. (1833).—Salm, Hort. Dyck. 8, 306. (1834); Bonplandia. **7:** 91. (1859); Wochenschr. Ver. Beförd. Gartenbau. **1861:** 182; Fl. des Jard. **1862:** 123.—Herbert, Amaryll. 127. (1837).—Steudel, Nom. 2 ed. 37. (1841).—Roemer, Fam. Synops. Monogr., Ensatae. 291. (1847).—Kunth, Enum. **5:** 836. (1850).—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1860:** 53; **1865:** 82, 102; Fl. des Jard. **1861:** 149; Belg. Hort. **1862:** 311.—Jacobi, Hamburg. Gart.-Zeit. **1864:** 460, 461, 502; **1865:** 260; Bull. Congr. Bot. et Hort. Amsterdam. 113. (1866); Versuch. 6, 8, 18, 142.—Baker, Gard. Chron. n s. **8:** 780. (1877); Handbook Amaryll. 193. (1888).—Ricasoli, Bull. Soc. Tosc. Ort. **3:** 306. (1878).—Hemsley, Biol. Centr.-Amer. **3: 347.** (1882–6).—Terracciano, Primo Contributo. 48. (1885).

? *A. pugioniferus* Cels, Cat. **1861:** 19.

? *A. macroacantha pugioniferus* Cels, Cat. **1865:** 18 & Systema.

A. pugioniforme Peacock, List. 3. (1878).

A. pugioniformes Segura, El Magney. 4 ed. 124. (1901).

A. subfalcata Jacobi, Wochenschr. Ver. Beförd. Gartenbau. **1869:** 179; Versuch. Nachtr. 2:75. (1870–1).—Baker, Gard. Chron. n. s. **8: 137.** (1877); Handbook Amaryll. 177. (1888).—Hemsley, Biol. Centr.-Amer. **3:** 345. (1882–6).—Terracciano, Primo Contributo. 29. (1885).

A. Bessereriana candida De Smet, Cat. **1869:** 14.—Baker, Gard. Chron. n. s. **8:** 137. (1877).

A. macrantha Baker, Gard. Chron. n. s. **8:** 137. *f. 27.*

A. Besseriana candida Terracciano, Primo Contributo. 29. (1885).—J. C., Gard. Chron. III. **38:** 346. (1905).

A. Bessereriana longifolia glauca Laurentius, Cat. **1869:** 16.

A. Besserreiana longifolia glauca Laurentius, Cat. **1869:** 15. *f.*

A. Besseriana longifolia glauca Jacobi, Wochenschr. Ver. Beförd. Gartenbau. **1869:** 179; Versuch. Nachtrag. 2:75. (1871).

A. Bessereriana glauca M., Fl. and Pomol. **1870:** 258. *f. 2;* Gard. Chron. **1871:** 74 *f. 20.*—Peacock, List. 2. (1878).

? *A. Corderoyii glauca* Corderoy, Gard. Chron. n. s. **8:** 469. (1877).

? *A. macracantha longifolia* Cat. Tender Pl. Fairmount Park. 5. [1907].

A. linearia Jacobi, Wochenschr. Ver. Beförd. Gartenbau. **1869:** 179.
A. Bessereriana longifolia viridis Laurentius, Cat. **1869:** 15, 16. *f.*
A. Besseriana longifolia viridis Jacobi, Wochenschr. Ver. Beförd. Gartenbau. **1869:** 179; Versuch. Nachtrag. 2:76. (1871).
A. Bessereriana viridis M., Fl. & Pomol. **1870:** 258. *f. 1.*
A. Bessereriana T. M., Gard. Chron. **1871:** 74. *f. 19.*
A. linearis Jacobi, Versuch. Nachtrag. 2:76. (1871).—Baker, Gard. Chron. n. s. **8:** 137. (1877); Handbook. 177. (1888).—Hemsley, Biol. Centr.-Amer. **3:** 345. (1882–6).—Terracciano, Primo Contributo. 29. (1885).
A. paucifolia Baker, Gard. Chron. n. s. **9:** 266. (1878); Handbook Amaryll. 177. (1888).—Hamburg. Gart.-Zeit. **1878:** 185.—Gartenflora. **27:** 321. (1878).—Belg. Hort. **1879:** 115.—Hemsley, Biol. Cent.-Amer. **3:** 347. (1882–6).
A. oligophylla Baker, Gard. Chron. n. s. **10:** 492. (1878); Handbook Amaryll. 177. (1888).—Segura, El Maguey. 4 ed. 84. (1901).
A. Besseriana major Garden. **7:** 456. (1875).—Belg. Hort. **1875:** 43.
A. Bessereriana major Peacock, List. 2. (1878).
A. concinna Baker, Gard. Chron. n. s. **8:** 137. (1877); Handbook Amaryllid. 178. (1888).—Ricasoli, Bull. Soc. Tosc. Ort. **3:** 237. (1878).—Hemsley, Biol. Centr.-Amer. **3:** 341. (1882–6).—Terracciano, Primo Contributo. 29. (1885).—Kew Hand List Tend. Monocot. 109. (1897).—Segura, El Maguey. 4 ed. 85. (1901).
A. sudburyensis Baker, Gard. Chron. n. s. **8:** 137. (1877).—Peacock, List. 2. (1878).—Terracciano, Primo Contributo. 29. (1885).
A. macracantha concinna Terracciano, Primo Contributo. 29. (1885).
? *A. integrifolia* Baker, Handbook Amaryll. 185. (1888).—Voss & Siebert, Vilmorin's Blumengärtn. 1037. (1896).—Kew Hand List Tend. Monocot. 113. (1897).—Terracciano, Bull. R. Ort. Bot. Palermo. **1:** 24. (1897).—Segura, El Maguey. 4 ed. 105. (1901).

Glaucous throughout. Leaves forming a hemispherical or globose cluster along a very short trunk, gray on a yellowish-green ground color, dull, thick and rigid, straight or sometimes falcately curved laterally, plano- or somewhat concavo-convex or even biconvex, uniformly spreading, becoming strongly reflexed at flowering, lanceolate to oblong-lanceolate, 1.8–4 (or exceptionally 7) × 20–55 cm.: spine slightly curved, blackish or dark brown, strong and stout, 4–6 or 7 × 15–25 (or exceptionally 45–65 mm.), openly and rather deeply obliquely grooved for much of its length, sometimes triquetrous, the raised sides shortly decurrent and the center sometimes projecting as a median prolongation into the tissue of the leaf: prickles of the same color, 5–50 (usually 15–20) mm. apart (exceptionally wanting? and often small and close near the base), on very heavy bases often fleshy below, strong, 2–3 (or even 5) mm. long, straight or somewhat curved, mostly upwards, the herbaceous margin commonly granular-roughened and in an aberrant broader form somewhat repand

between them. Inflorescence about 3 m. high, laxly oblong-paniculate in the upper half: pedicels 2 × 1–3 mm. Flowers very glaucous, green, with a slight purple tinge: ovary 6–7 × 20–25 mm.: tube of perianth oblong-conical, 8 × 12–15 mm., bearing the filaments about its middle; segments mostly arcuately incurved, 3 × 15 mm.: style and filaments abundantly dotted with purple, 30–40 mm. long: anthers yellow-green, purple-dotted. Capsules blue glaucous, broadly oblong, attenuate at each end, stipitate and beaked, 25–30 × 40–55 mm., with a sparse lacework of fine fibers between the valves below in dehiscence: seeds black, very dull, 6–7 × 8–9 mm.—*Plates 18–28.*

Mexican table-land, from Tehuacan southward at least as far as the southern part of the Tomellin Cañon.

Specimens examined:—*Spontaneous:* Tehuacan, Trelease, August 1903, about the northern foot of the Cerro Colorado where it is the prevalent species of this group, called "espadilla;" Rose & Rose, September 1906, no. 11263. Mexia, in the Tomellin Cañon, Trelease, February 1905.—*Cultivated:* Missouri Botanical Garden, 1888, 1892, 1906. Munich Garden, as *A. pugioniformis*, June 12, 1853. Palermo Garden, Borzí, 1905,—an aberrant leaf with the open attenuate spine 5 × 50 mm.

As the only segregates that appear possible with present material, may be noted:—

Leaves of the normal form and size, entire.	var. *integrifolia.*
Leaves large and broad, repand.	var. *latifolia.*

The first of these is Mr. Baker's *A. integrifolia*, which possibly belongs to an entirely different group, and of which nothing further seems now ascertainable unless the type, which was still living in 1897, may exist at Kew. The second, which perhaps is *A. Bessereriana major*, and also *A. sudburyensis* of the Peacock garden that was made the type of *A. concinna* Baker, is known to me only from two large sterile plants observed in February 1905 in the mountains behind the Riego hotel at Tehuacan, and from a leaf sent from Tehuacan by Dr. R. Endlich in 1907 (no. 1929). Its large somewhat flexuous spine and subrepand margin suggest a possibility of hybridization with the associated *A. Verschaffeltii.* A plant cultivated at Fairmount Park as *A. macracantha longifolia*, though clearly of this species, is peculiar in

that the unusually large fleshy cushions of the prickles commonly point obliquely downwards.

The remarkable pedicel-like ovaries and larger flowers of the Munich sheet of *A. pugioniformis*, if reobserved with the narrower type of foliage may subsequently afford means for the segregation of the latter species.

AGAVE KARWINSKII Zuccarini, Act. Acad. Caes. Leop. Carol. **16²**: 677. (1833).—Steudel, Nom. 2 ed. 36. (1841).—Otto, Allgem. Gartenzeit. **1842**: 50.—Roemer, Fam. Synops. Monogr., Ensatae. 291. (1847).—Kunth, Enum. **5**: 837. (1850).—Salm, Bonplandia. **7**: 90. (1859); Wochenschr. Ver. Beförd. Gartenbau. **1861**: 182; Fl. des Jard. **1862**: 123.—Jacobi, Hamburg. Gart.-Zeit. **1864**: 460, 461, 500; **1865**: 156; Bull. Cong. Bot. et Hort. Amsterdam. 111. (1866); Versuch. 6, 8, 16, 93.—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1865**: 101.—Engelmann, Trans. Acad. St. Louis. **3**: 317. (1875); Bot. Works. 312. (1887).—Baker, Gard. Chron. n. s. **8**: 397. (1877); Handbook Amaryll. 181. (1888).—Hemsley, Biol. Centr.-Amer. **3**: 348. (1882-6).—Terracciano, Primo Contributo. 44. (1885).—Weber in Bois, Dict. 52. (1893).

A. Karwinskiana Herbert, Amaryll. 128. (1837).—Kunth, Enum. **5**: 837. (1850).—Terracciano, Primo Contributo. 44. (1885).

A. Karwinskyi Koch, Wochenschr. Ver. Beförd. Gartenbau. **3**: 48. (1860); Fl. des Jard. **1861**: 148; Belg. Hort. **1862**: 310.

? *A. Karwinsky* Groenewegen, Cat. **1866**: 47.

? *A. Karewinskii* Peacock, List. 2. (1878).

A. sp. MacDougal, Journ. N. Y. Bot. Gard. **8**: 9. *f. 6.* (1907).—Trelease, Pop. Sci. Monthly. **70**: 219. (1907).

A. Corderoyii De Smet, Cat. **1869**: 14.—Peacock, List. 2. (1878).—Corderoy, Gard. Chron. n. s. **8**: 469. (1877).—Without description.

A. Corderoyi Belg. Hort. **1874**: 25.—Without description.—**Baker, Gard. Chron. n. s. 8**: 398. *f. 79.* (1877); Handbook Amaryll. 182. (1888).—Ricasoli, Bull. Soc. Tosc. Ort. **3**: 241. (1878).—Belg. Hort. **1880**: 276.—Terracciano, Primo Contributo. 45. (1885.)—Nicholson, Dict. Gard. **1**: 39.—Dodge, Rept. Fiber Invest. (U. S. Dep. Agr.). 5: 43. (1893).—Kew Hand List Tend. Monocot. 109. (1897).—Von der Heiden, Cat. **1879**: 11.—Rose in Bailey, Cyclop. Amer. Hort. **1**: 36. (1900).—Segura, El Maguey. 4 ed. 95. (1901).—Braun, Der Pflanzer. **2**: 233. (1906).

? *A. Corderoyi brevifolia* Belg. Hort. **1875 :** 43.

? *A. Corderoyi longifolia* Von der Heiden, Cat. **1879 :** 11.

A. Bakeri Ross, Boll. Soc. Sc. Nat. ed Econom. Palermo. **1894**[3]; Icon. et Descr. Panorm. 4. *pl. 2.* (1896).—Terracciano, Boll. R. Ort. Bot. Palermo. **2 :** 126. (1898).

?? *A. laxa* Salm, Hort. Dyck. 8. (1834).—Steudel, Nom. 2 ed. 36. (1841).—Otto, Allgem. Gartenzeit. **1842 :** 50, 51.—Roemer, Fam. Synops. Monogr., Ensatae. 292. (1847).—Kunth, Enum. **5 :** 837–8. (1850).—Thus far, name only.—**Salm,** Bonplandia **7 :** 90. (1859); Wochenschr. Ver. Beförd. Gartenbau. **1861 :** 182; Fl. des Jard. 1862: 124.—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1860 :** 48; Fl. des Jard. **1861 :** 148; Belg. Hort. **1862 :** 310.—Jacobi, Hamburg. Garten-Zeit. **1864 :** 460; **1865 :** 263; Bull. Cong. Bot. et Hort. Amsterdam. 113. (1866); Versuch. 146.—Terracciano, Primo Contributo. 44. (1885).

Usually not at all, and at most transiently, glaucescent. Leaves forming an oblong cluster along a trunk at length 1–3 or 4 m. high, light or olive green, dull or slightly glossy, thick and rigid, usually straight, concavo-convex, ascending to reflexed, narrowly oblong or lanceolate, 1.5–4 × 35–70 cm.: spine from dark brown becoming grayish, strong and stout, 3–6 × 25–50 mm., terete or somewhat triquetrously keeled, openly and shallowly grooved below, the raised sides decurrent sometimes for an equal or greater length and the center usually projecting as a median point into the tissue of the leaf: prickles nearly black, on mature leaves 25–45 mm. apart, sometimes closer near the base, stout and strong, 3–(mostly) 5 mm. long, their gradually acute long cusps usually strongly upcurved, the little raised bases sometimes rhombically inserted, the margin nearly straight and usually smooth between them. Inflorescence 4–6 m. high, laxly oblong-paniculate in the upper half: pedicels 2 × 2–3 mm. Flowers olive, brownish, or purplish green: ovary 7–9 × 25 mm.: tube of perianth oblong-conical, 10–12 × 10–18 mm., bearing the filaments above its middle; segments erect, 4–5 × 15 mm.: style and filaments dotted with purple, 35–45 mm. long. Capsules oblong, brown, shortly stipitate and beaked, 25 × 35–50 mm., the dehiscent valves sparingly connected by interlacing fibers: seeds black, somewhat glossy, apparently narrower, 4–6 × 8 mm.—*Plates 29–31 f. 1.*

Mexican table-land, from Tehuacan southward at least as far as Mitla, where it is somewhat planted for hedges.

Specimens examined:—*Spontaneous:* Tehuacan, Trelease, August 1903, especially abundant between the southern side of the Cerro Colorado and the village La Huerta, called "candellillo," and an aberrant form with enormous open end spines 7 × 40 mm., Trelease, February 1905; Rose and Rose,

September 1906, no. 11262. Mitla, Rose and Rose, September 1906, no. 11302, 11310.—*Cultivated:* Missouri Botanical Garden in 1888, 1899 and 1906 (as *A. Corderoyi*). Palermo Botanical Garden, 1905 (as *A. Bakeri*).

AGAVE RUBESCENS Salm, Hort. Dyck. 8, 306. (1834); Bonplandia. **7:** 91. (1859); Wochenschr. Ver. Beförd. Gartenbau. **1861:** 182; Fl. des Jard. **1862:** 124.—Bosse, Handbuch. 205. (1840).—Steudel, Nom. 2 ed. 37. (1841).—Otto, Allgem. Gartenzeit. **1842:** 51.—Roemer, Fam. Synops. Monogr., Ensatae. 292. (1847).—Kunth, Enum. **5:** 835 (1850).—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1860:** 54; Fl. des Jard. **1861:** 150; Belg. Hort. **1862:** 313.—Jacobi, Hamburg. Gart.-Zeit. **1864:** 460; 502; **1865:** 261; Bull. Cong. Bot. et Hort. Amsterdam. 113. (1866); Versuch. 6, 143.—Baker, Gard. Chron. n. s. **8:** 780. (1877); Handbook Amaryll. 194. (1888).—Ricasoli, Bull. Soc. Tosc. Ort. **3:** 306. (1878).—Hemsley, Biol. Centr.-Amer. **3:** 348. (1882–6).—Segura, El Maguey. 4 ed. 126. (1901).

A. flaccida Salm, Hort. Dyck. 306. (1834); Bonplandia, **7:** 91. (1859).—Steudel, Nom. 2 ed. 36. (1841).—Otto, Allgem. Gartenzeit. **1842:** 51.—Kunth, Enum. **5:** 835. (1850).—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1860:** 54; **1865:** 101; Fl. des Jard. **1861:** 150; Belg. Hort. **1862:** 313.—Jacobi, Hamburg. Gart.-Zeit. **1864:** 461; Versuch. 6.

A. punctata Salm, Hort. Dyck. 8, 306. (1834); Bonplandia, **7:** 91. (1859).—Steudel, Nom. 2 ed. 37. (1841).—? Otto, Allgem. Gartenzeit. **1842:** 50.—Roemer, Fam. Synops. Monogr., Ensatae. 292. (1847).—Kunth, Enum. **5:** 837. (1850).—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1860:** 54; Fl. des Jard. **1861:** 150; Belg. Hort. **1862:** 313.—Jacobi, Hamburg. Gart.-Zeit. **1864:** 460, 461, 502; Bull. Congr. Bot. et Hort. Amsterdam. 113. (1866); Versuch. 6, 18, 143.—Terracciano, Primo Contributo. 44. (1885).

? *A. serrulata* Steudel, Nom. 2 ed. 37. (1841).—Otto, Allgem. Gartenzeit. **1842:** 51.—Roemer, Fam. Synops. Monogr., Ensatae. 292. (1847).—Kunth, Enum. **5:** 838. (1850).—Thus far without description.—**Salm,** Bonplandia. **7:** 91. (1859); Wochenschr. Ver. Beförd. Gartenbau. **1861:** 182; Fl. des Jard **1862:** 124.—Koch, Wochenschr. Ver. Beförd. Gartenbau. **1860:** 54; Fl. des Jard. **1861:** 150; Belg. Hort. **1862:** 312.—Jacobi, Hamburg. Gart.-Zeit. **1864:** 461, 502; **1865:** 260; Bull. Cong. Bot. et Hort. Amsterdam. 113. (1866);

Versuch. 6, 8, 18, 142.—Baker, Gard. Chron. n. s. **8**: 780. (1877); Handbook Amaryll. 193. (1888).—Ricasoli, Bull. Soc. Tosc. Ort. **3**: 306. (1878).—Hemsley, Biol. Centr.-Amer. **3**: 350. (1882–6).—Terracciano, Primo Contributo. 47. (1885).—Segura, El Maguey. 4 ed. 125. (1901).

A. densispina Cels, Cat. **1865.** Systema.

?? *A. erubescens* Ellemeet, Belg. Hort. **1871**: 119.—Terracciano, Bull. R. Ort. Bot. Palermo. **1**: 26. (1897).—Rose in Bailey, Cyclop. Amer. Hort **1**: 36. (1900).

Essentially acaulescent. Leaves gray-green rather than glaucous; often purple tinged, rather thin, subflaccid, concave and often recurving, when young, rigidly spreading in maturity, elongate-lanceolate to oblong, at length 5 × 75 cm.: spine gray- or purple-brown, somewhat flexuous, strong and rather stout, 4 × 25 mm., at length openly obliquely grooved, with a low median keel, the raised sides shortly decurrent: prickles from orange becoming brown, 5–10 or in maturity mostly 10–20 or 25 mm. apart, narrow-based, very slender, at length 3–4 mm. long, upcurved, sometimes with a double flexure, the yellow cartilaginous nearly smooth margin straight between them. Inflorescence some 3 m. high, paniculate above. Flowers and capsules unknown. Seeds black, very dull, large, 7–8 × 11 mm.—*Plates 31 f. 2–34.*

Mexican table-land, in the vicinity of Oaxaca.

Specimens examined:—North of Tehuacan, Endlich, April 1907, no. 1918. El Parian, on the Mexican Southern Railroad, Trelease, February 1905, mature foliage and a young leaf corresponding to the type description;—a small specimen from the same collection cultivated at the Missouri Botanical Garden.

Smaller seeds, 5–6 × 8–9 mm., collected from an old inflorescence on the road between Oaxaca and Mitla (Trelease, March 1903, no. 169–03) in association with *A. Karwinskii*, to which they were supposed to belong, have developed into seedlings obviously different from the latter, and belonging near to if they do not actually represent *A. rubescens*. It is possible that young plants from the Sartorius finca "El Mirador," to the northeast, collected by Purpus, also represent this species.

A. rubescens, as here understood, is apparently of the alliance of *A. tequilana* and its relatives of the western slope, the "zapupe" of the Southeast, and the Indian species *A. Cantala:* the marginal prickles of mature leaves are almost exactly those of *A. Jacquiniana*, but the end spine is here

decurrent along a short quadrate channel, while it stops abruptly in the latter, which is one of the "Sisalanae." The present description, from very scanty material, may serve for its differentiation from its geographic associates only.

EXPLANATION OF PLATES.

Plate 18.—*Agave macroacantha*, one specimen with denuded old panicle, at the northern side of the Cerro Colorado, Tehuacan, August 1903.

Plate 19.—*Agave macroacantha*. Above, two specimens at the northern side of the Cerro Colorado, Tehuacan, August 1903. Below, two specimen plants grown at the Missouri Botanical Garden as *A. Besseriana*, 1887.

Plate 20.—*Agave macroacantha* in an early stage of flowering. One of the Missouri Botanical Garden plants of *A. Besseriana*, July 1906.

Plate 21.—*Agave macroacantha*. The same plant, bearing numerous bulbils after flowering, autumn of 1906.

Plate 22.—*Agave macroacantha*. Apex and base of leaf of the same garden plant, July 1906, natural size.

Plate 23.—*Agave macroacantha*, in fruit, on the hills above Mexia, February, 1905.

Plate 24.—*Agave macroacantha*. Flowers, partly grown capsule, and young bulbils of the Missouri Botanical Garden plant, 1906, natural size.

Plate 25.—*Agave macroacantha*. Capsules, seeds and seedlings of the Mexia plant (the latter two years old), natural size.

Plate 26.—*Agave macroacantha*? *Agave pugioniformis* of the Munich Botanical Garden, June 12, 1853, natural size.—Obligingly photographed by Professor Radlkofer in 1906.

Plate 27.—*Agave macroacantha latifolia*, west of Tehuacan, February 1905.

Plate 28.—*Agave macroacantha latifolia*, showing spines and marginal characters of several leaves of the above, natural size.

Plate 29.—*Agave Karwinskii*, before the Cerro Colorado back of La Huerta, near Tehuacan, August 1903.

Plate 30.—*Agave Karwinskii*, near Mitla.— Photographed by Professor MacDougal in September 1906.

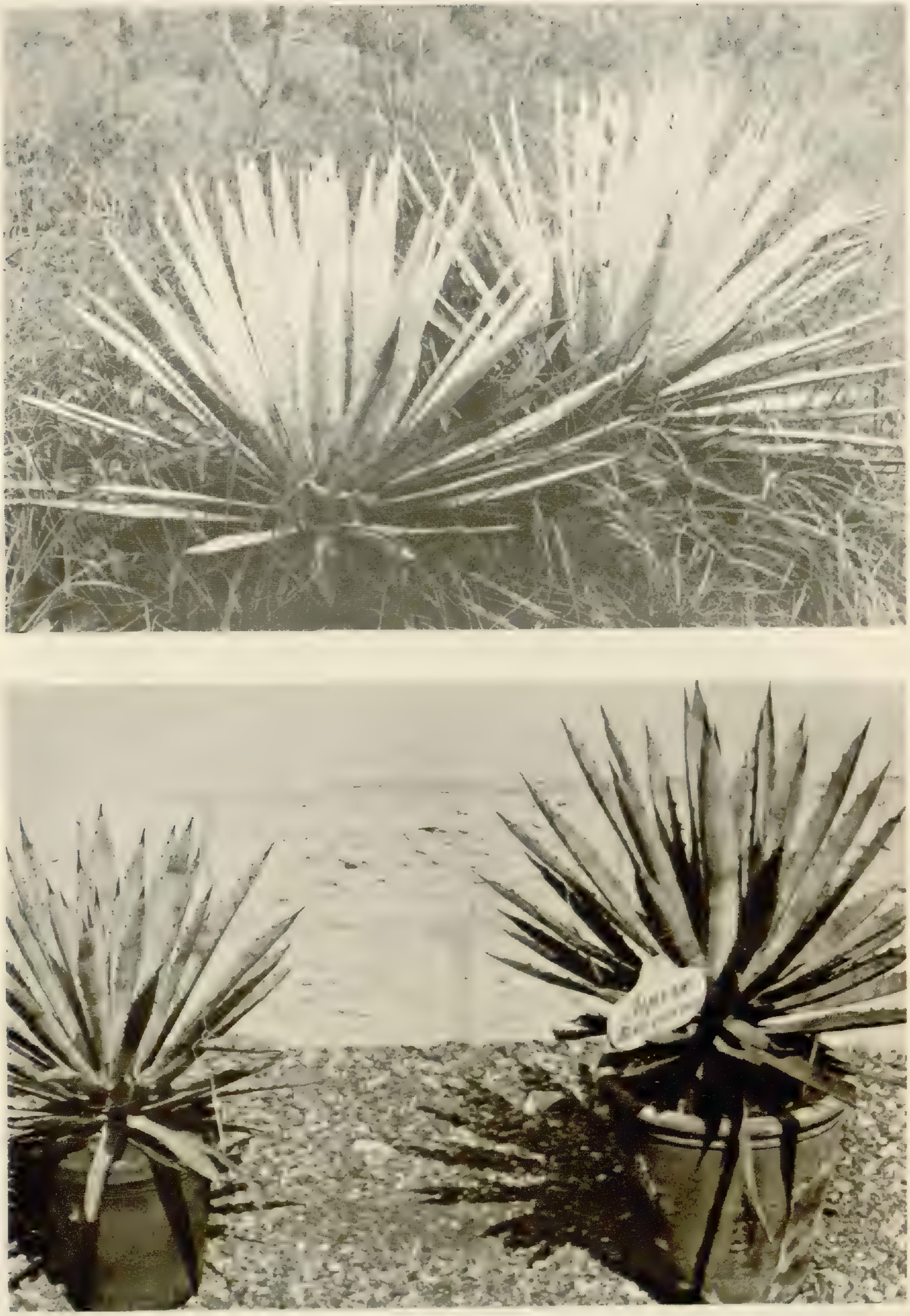
Plate 31.—*Agave Karwinskii*. Capsules, from Tehuacan. Rose & Rose, no. 11262, natural size. *A. rubescens*? Seed, from Mitla road, natural size.

Plate 32.—*Agave rubescens*. Young plant from El Parian, cultivated at the Missouri Botanical Garden, 1907.

Plate 33.—*Agave rubescens*. Below, leaves of the young garden plant. Above, leaf collected from a young plant at El Parian, natural size.

Plate 34.—*Agave rubescens*. Spine and margin of leaf from near Tehuacan, Endlich, no. 1918; and, below, end and middle of a mature leaf from El Parian, natural size.

AGAVE MACROACANTHA.



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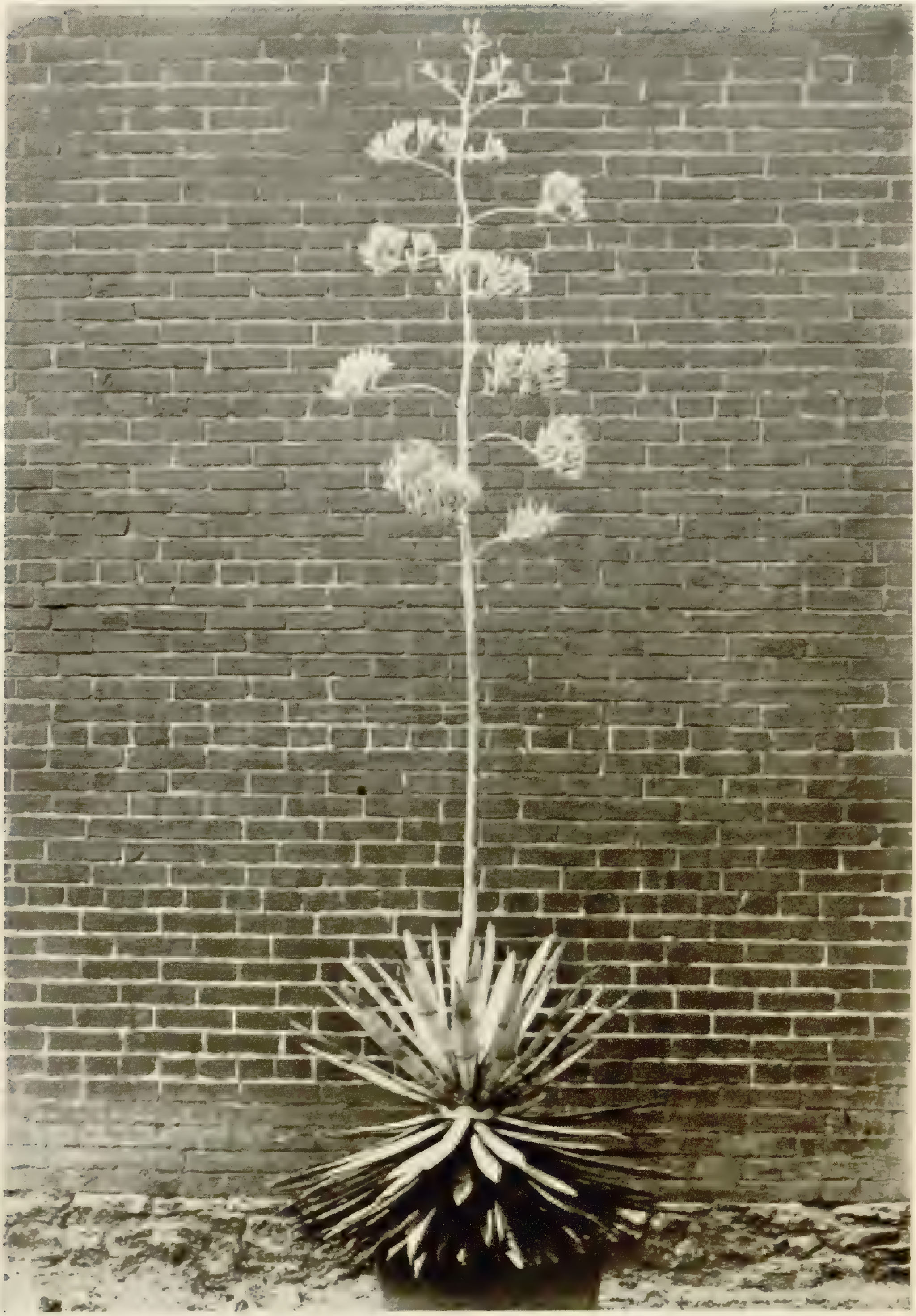

AGAVE MACROACANTHA.

AGAVE MACROACANTHA.

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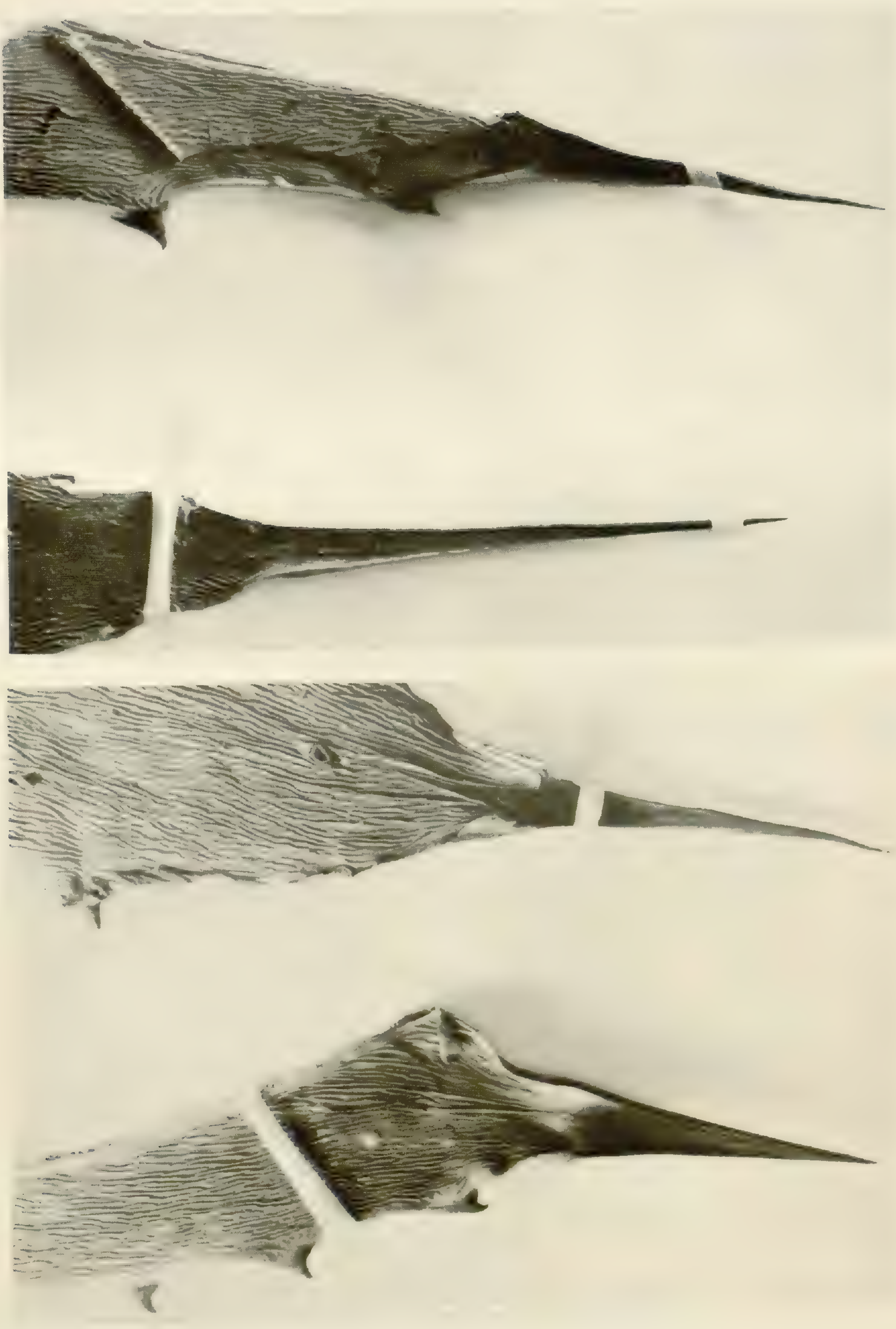
AGAVE MACROACANTHA.

AGAVE MACROACANTHA (PUGIONIFORMIS).

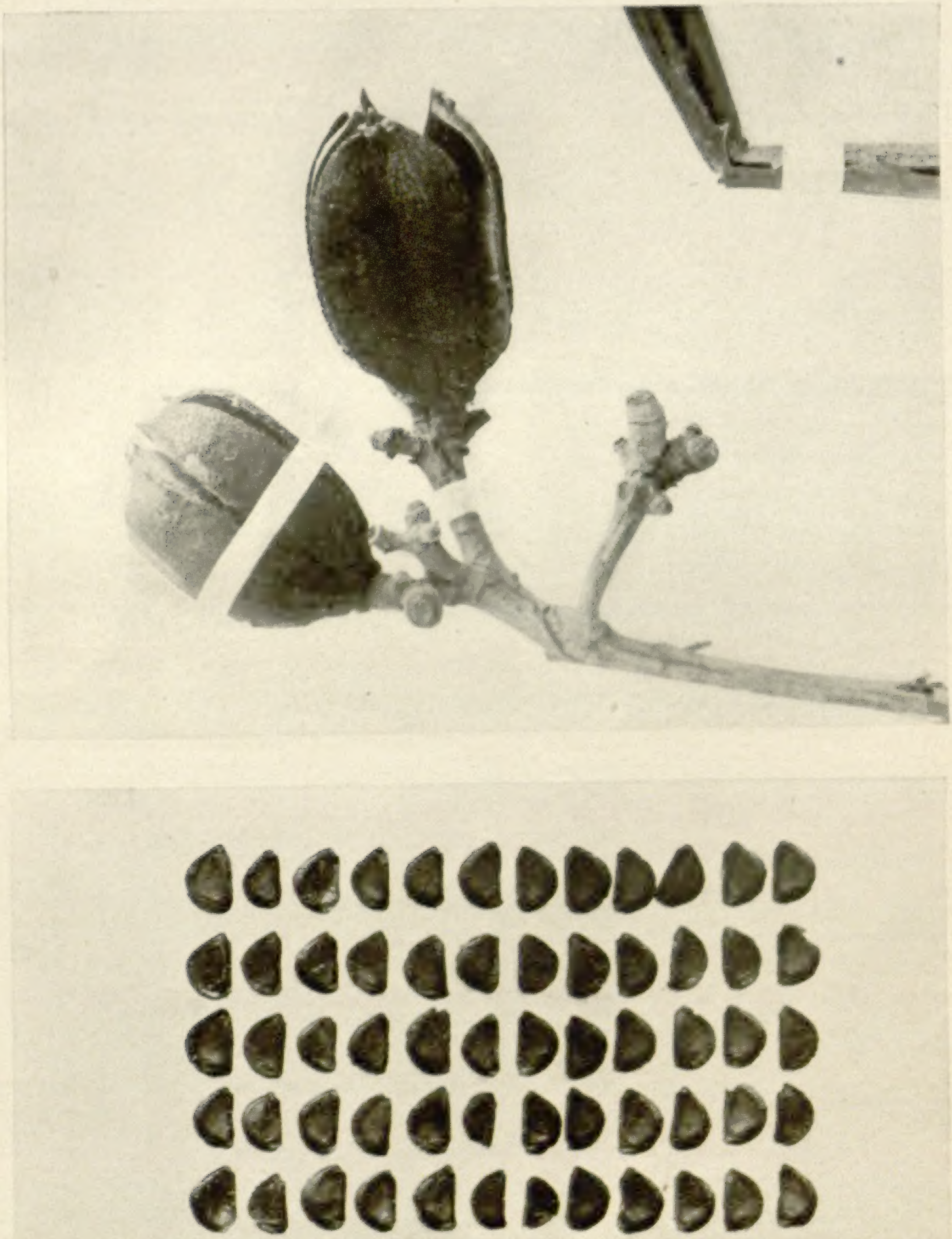
AGAVE MACROACANTHA LATIFOLIA.



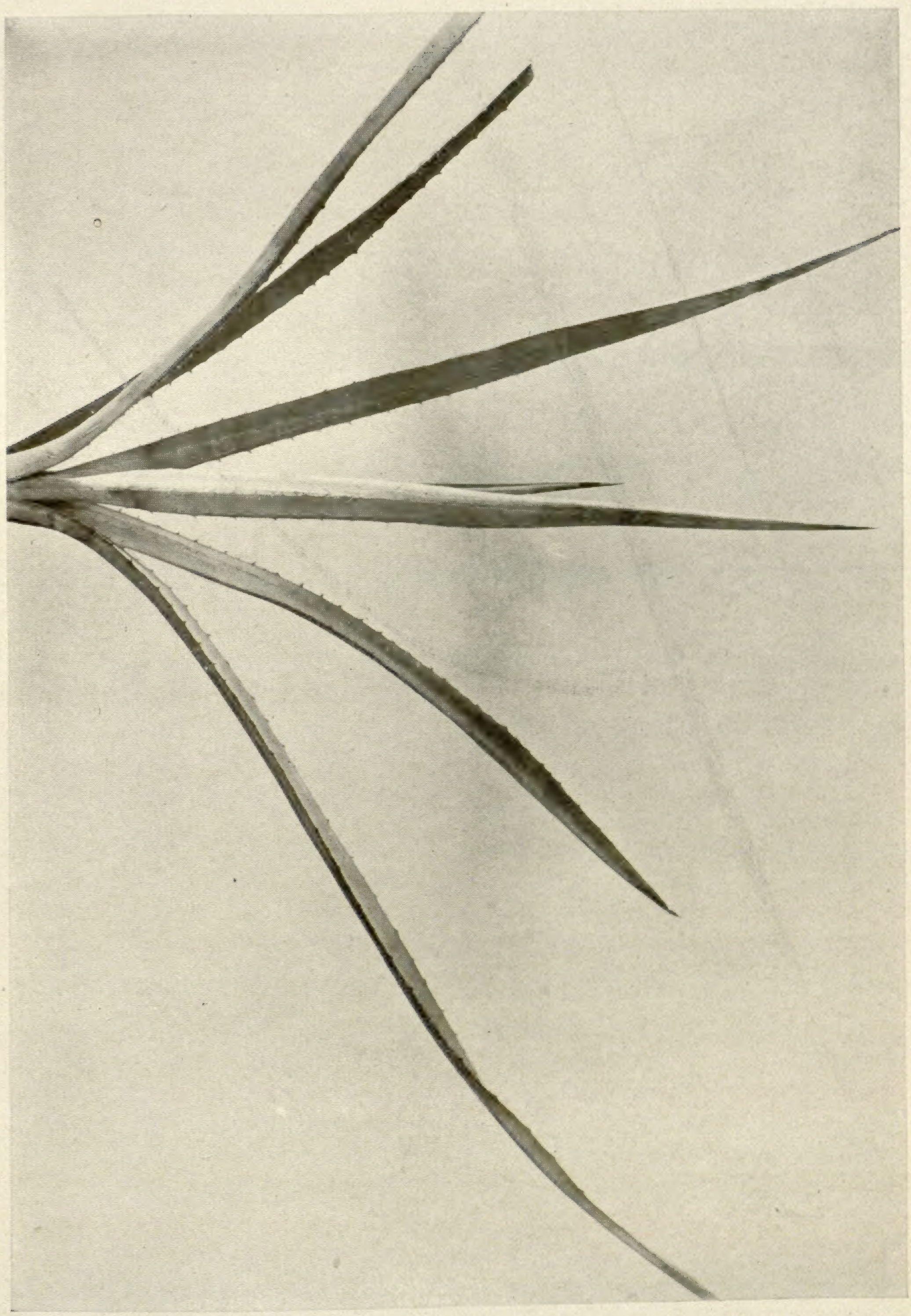
AGAVE MACROACANTHA LATIFOLIA.

AGAVE KARWINSKII.

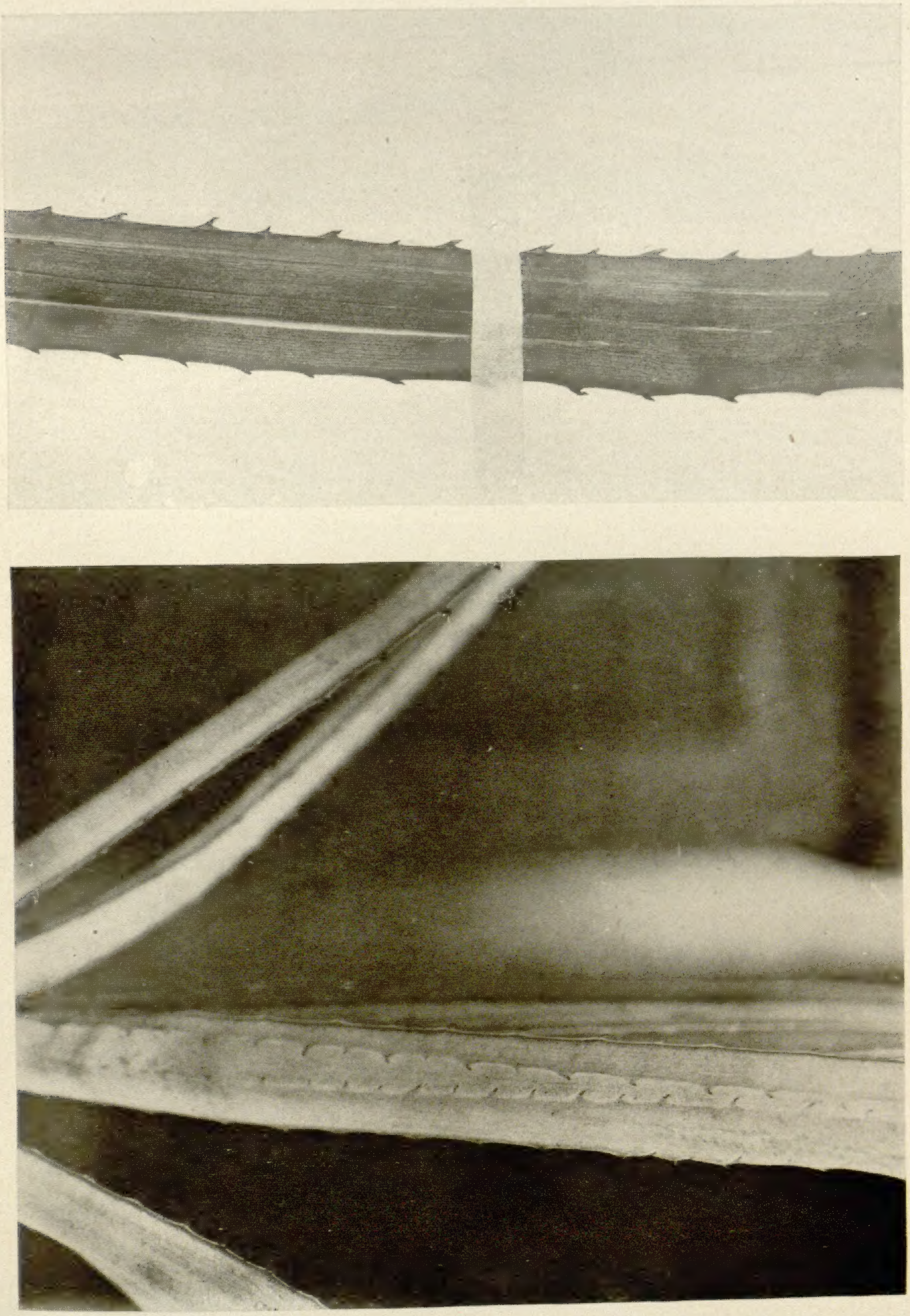
AGAVE KARWINSKII.



AGAVE KARWINSKII and A. RUBESCENS.



AGAVE RUBESCENS.



AGAVE RUBESCENS.

AGAVE RUBESCENS.